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APPENDICES

Appendix A: Raw Materials

A.1. Raw Material

A.1.1. Iron Ore

Iron ore, obtained from Xieng Khouang Lao PDR, is the iron oxide used in the iron production. In the present work, a low grade Iron ore was used which has %Fe between 40-60 %. The iron ore (XK-01) was characterized for the wt % of elements by EDX (Energy Dispersive X-Ray Fluorescence Spectrometer), the structures by XRD (X-Ray Diffraction Spectrometer) and the compositions by the Wet Chemical Analysis. Characterization methods and results are presented in A.2 Characterization.

A.1.2. Reductant

Reductant is a substance used to reduce Oxygen in an iron ore. In the present study, Dai coal, obtained from Xieng Khouang Lao PDR, was analyzed for the Proximate Analysis and the structures by a XRD (X-Ray diffraction spectrometer). Characterization methods and results are presented in A.2 Characterization.

A.1.3. Flux

Limestone is a flux used to separate iron from slag or other components during the reduction process. Limestone was obtained from CP® (Thailand) and used in our experiment; the specification of the Limestone is presented in A.4 Raw Material Characterization.

A.1.4. Binder

Bentonite is a binder used in making a pellet. The sodium bentonite was obtained from Volclay Siam Ltd. and used in our experiments. The specification

of a Bentonite from Volclay Siam Ltd. is presented in A.4 Raw Material Characterization.

A.2. Characterization

A.2.1. Energy Dispersive X-Ray Fluorescence (EDXRF)

Samples were characterized for wt % of elements by EDX (Horiba, model 51-ADD0014), an Energy Dispersive X-Ray Fluorescence Spectrometer (Hitachi, model S-4800), connected to a scanning electron microscope. The samples were ground into fine particles (0.043 mm in average diameter as shown in Table A-1). The SEM accelerating voltage and current were 25 kV and 20 μA, respectively. The magnification was 100X. The pellets were stacked onto stubs by using sticker carbon papers. The specimens were coated with platinum using an ion coating machine (Hitachi, model E-1010) for 90 sec, for enhancing the electron conductivity. The specimens were clamped on a holder and placed into a high vacuum SEM chamber for preventing the attenuation of X-ray by the air molecules. 3 measurements were taken from different parts of each sample. The peaks of platinum were subtracted out before calculating the total wt % element and the % atomic of the specimens.

A.2.2. X-Ray Diffraction (XRD)

The sample was characterized for its structures by XRD or a X-Ray diffraction spectrometer (Rigaku D/max; model 2000). The specimens were placed on a glass slide, clamped on the sample holder, and then exposed to the X-ray source. The anode tube of the X-ray source was Copper K-alpha. The operating voltage and current were 40 kV and 30 mA, respectively. The measurement angle (2□) was from 5 degree to 90 degree with a scanning speed of 5 degree/min, and under the wide angle mode. One sample was divided into 3 specimens for each measurement. Each specimen was chosen randomly from the whole lot of the sample.

A.2.3. Scanning Electron Microscope (SEM)

Sample particle sizes were measured by SEM (Hitachi, model S-4800), a scanning electron microscope. The SEM accelerating voltage, current, and magnification are specified in the figures below. The particles were stacked onto stubs by using sticker carbon papers. The specimens were coated with platinum using the ion coating machine (Hitachi, model E-1010) for 90 sec, for enhancing the electron conductivity. The specimens were clamped on the holder and placed into the high vacuum SEM chamber for preventing the attenuation of X-ray by the air molecules.

A.2.4. Wet Chemical Analysis

XK-01 iron ore was also analyzed for its compositions by the Wet Chemical Analysis at the Rock and Mineral Analysis Department of Mineral Resources, Ministry of Natural Resources and Environment Thailand.

A.2.5. Proximate Analysis

The Dai coal was analyzed by the Proximate Analysis by the Electricity Generating Authority of Thailand, Mar Moh, Lampaeng.

A.2.6. Microstructure Analysis

The Iron nugget from suitable condition was prepared the surface by using P1200 glass paper and Aluminum powder (particle size $\geq$ 5 μm). After the surface was clear, the 2 % Nitral was used to etching. The microstructure of Iron nugget was measured by SEM (Hitachi, model S-4800) as shown in A.2.3.

A.2.7. Density of Iron nugget

All of the iron nuggets were measured the density by pycnometer.

A.3. Raw Material Characterization

A.3.1. SEM Characterization

The SEM accelerating voltage, current and magnification are specified in Figures E-1 and E-2 in Appendix E. The results are presented in Table A-1.

Table A-1 Particle size of the raw materials

No.	Particle size			
	XK-01(mm)	Dai coal (mm)	Limestone (μm)	Bentonite (μm)
1	0.110	0.160	8.55	28.09
2	0.060	0.100	6.54	33.60
3	0.080	0.080	5.78	22.53
4	0.070	0.070	5.27	46.98
5	0.040	0.190	4.76	19.46
6	0.060	0.170	10.26	36.06
7	0.050	0.100	4.95	21.29
8	0.070	0.170	6.29	48.09
9	0.060	0.110	3.92	39.13
10	0.030	0.100	3.64	40.02
11	0.030	0.120	5.39	33.65
12	0.040	0.120	4.90	26.59
13	0.030	0.130	4.25	26.88
14	0.050	0.070	4.86	15.81
15	0.020	0.180	5.44	43.48
16	0.040	0.140	3.27	13.83
17	0.020	0.140	6.31	8.84
18	0.050	0.190	5.56	11.86
19	0.020	0.080	5.62	27.46
20	0.040	0.230	3.27	33.54
21	0.030	0.130	3.81	32.89
22	0.040	0.220	4.58	25.77
23	0.040	0.100	3.73	21.38
24	0.020	0.070	7.63	23.72
25	0.020	0.080	4.44	15.93
26	0.040	0.040	5.78	21.01
27	0.030	0.020	1.63	31.93
28	0.020	0.040	2.38	25.31
29	0.040	0.040	3.33	15.81
30	0.030	0.050	4.76	38.37
average	0.043	0.115	5.03	27.64
SD	0.021	0.056	1.76	10.37
Min–Max	0.110-0.020	0.220-0.020	1.63-10.26	8.84-48.09

A.3.2. EDX Characterization

The % wt of element and the % atomic of the XK-01 iron ore are tabulated in Table A-2.

Table A-2 % wt Element and % Atomic of XK-01

Sample Name	C	O	Al	Si	K	Fe	Zr	Mn	Ca	Ti	Au	Cu	P	S	Mg	Na	Cl
1st	5.67	32.63	1.74	2.57	0.26	56.00	0.93	0.00	0.00	0.03	0.00	0.05	0.12	0.00	0.00	0.00	0.00
2nd	10.60	33.71	1.74	2.14	0.32	50.39	0.88	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00
3rd	1.58	31.77	1.58	2.12	0.20	61.59	0.82	0.00	0.00	0.05	0.00	0.10	0.21	0.00	0.00	0.00	0.00
Average	5.95	32.70	1.69	2.28	0.26	55.99	0.87	0.00	0.00	0.03	0.00	0.05	0.18	0.00	0.00	0.00	0.00
SD	4.52	0.93	0.10	0.26	0.06	5.60	0.05	0.00	0.00	0.03	0.00	0.05	0.06	0.00	0.00	0.00	0.00

A.3.3. XRD Characterization

Results XRD of XK-01 iron ore and the Dai coal are shown in table A-2 and A-3

Table A-3 XRD Characterization of XK-01

XK-01	Types of Compounds														
1	SiC	Fe_2O_3	SiO_2	Al_2SiO_5	$Fe_3Al_2(SiO_4)_3$	N/A	N/A	Fe_2TiO_5	Fe_2SiO_4	$Al_2(SiO_4)O$	N/A	N/A	N/A	N/A	N/A
2	SiC	Fe_2O_3	SiO_2	Al_2SiO_5	$Fe_3Al_2(SiO_4)_3$	TiO_2	$Fe_{1.6}SiO_4$	N/A	N/A	N/A	$Fe_2Ti_3O_9$	Fe_3C	Fe_3Si	N/A	N/A
3	SiC	Fe_2O_3	SiO_2	Al_2SiO_5	N/A	TiO_2	$Fe_{1.6}SiO_4$	N/A	N/A	N/A	N/A	N/A	N/A	$FeSi_2$	C

Table A-4 XRD Characterization of the Dai coal

Dai coal	Types of Compounds												
1	C	S	SiO_2	$Al_2(SO_4)_3$	Al_2SiO_5	$Mg_2Al_4Si_5O_{18}$	$Fe_2(SO_4)_3$	N/A	N/A	$Fe_2Al_4Si_5O_{18}$	Fe_2O_3	$(Fe\,Mg)_2SiO_4$	N/A
2	C	S	SiO_2	$Al_2(SO_4)_3$	Al_2SiO_5	$Mg_2Al_4Si_5O_{18}$	$Fe_2(SO_4)_3$	Fe_7S_8	$MgSiO_4$	N/A	Fe_2O_3	$(Fe\,Mg)_2SiO_4$	N/A
3	C	S	SiO_2	$Al_2(SO_4)_3$	Al_2SiO_5	$Mg_2Al_4Si_5O_{18}$	$Fe_2(SO_4)_3$	Fe_7S_8	$MgSiO_3$	$Fe_7Al_4Si_5O_{18}$	N/A	N/A	$(Fe\,Mg)SiO_3$

A.3.4. Wet Chemical Analysis Results

Results of the XK-01 iron ore from the Rock and Mineral Analysis Department of Mineral Resources, Ministry of Natural Resources and Environment Thailand are shown in Table A-5.

Table A-5 Composition of the XK-01 iron ore by the Wet Chemical Analysis from the Rock and Mineral Analysis Department of Mineral Resources, Thailand

Composition	Wt %
Fe2O3	80.95
FeO	1.28
SiO2	4.34
Al2O3	1.65
CaO	0.14
MgO	0.05
Na2O	0.06
K2O	0.16
H2O	0.57

A.3.5. Proximate Analysis

The Dai coal Proximate Analysis was obtained from the Electricity Generating Authority of Thailand. The results are presented in Table A-6.

Table A-6 Proximate Analysis of the Dai coal

	Parameter	Unit	Method	Result
As received basis	Moisture	% by weight	ASTM D3302-02a[S1]	21.29
	Ash	% by weight	ASTM D5142-09	5.97
	Volatile matter	% by weight	ASTM D5142-09	35.47
	Fixed carbon	% by weight	ASTM D5142-09	37.26
	Sulphur	% by weight	ASTM D4239-08 Method B	0.89
	Gross calorific value	MJ/kg Kcal/kg	ASTM D5865-0Ta	20.97 5012
	Net calorific value	MJ/kg Kcal/kg	ASTM D5865-0Ta	19.94 4766

A.3.6. Specifications Limestone and Bentonite from venders

Table A-6 shows the composition of the limestone from CP® (Thailand); it has an average molecule weight 99.311 of g/mol.

Table A-7 Composition of CP® limestone

Composition	% by weight	Mw	% by weight × Mw of composition
$CaCO_3$	99.08 %	100.076	99.155
$MgCO_3$	0.18 %	84.303	0.152
Moisture	0.02 %	18.000	0.004
Average			99.311

The composition of Sodium Bentonite from Volclay Siam Ltd. is shown in Table A-7. Bentonite has an average molecule weight of 73.615 g/mol.

Table A-8 Composition of Sodium Bentonite from Volclay Siam Ltd

Composition	% by weight	Mw	% by weight × Mw of composition
SiO_2	61.16	60.08	36.75
Al_2O_3	21.20	101.96	21.62
CoO	0.01	74.93	0.01
Fe_2O_3	5.09	159.69	8.13
P_2O_5	0.08	141.95	0.11
K_2O	0.70	94.20	0.66
TiO_2	0.19	79.87	0.15
MgO	2.96	40.30	1.19
CaO	4.12	56.08	2.31
Na_2O	1.76	54.99	0.97
WO_3	0.01	231.84	0.02
PbO	0.01	223.20	0.02
BaO	0.04	153.33	0.06
ZnO	0.01	81.41	0.01
ZrO_2	0.03	123.22	0.04
Mn_2O_3	0.03	157.87	0.05
H_2O	8.44	18.02	1.52
Average			73.62

Appendix B: Calculation of Pellet Mixtures

B.1 Mol Ratio of C/Fe

Reduction Equation of Hematite (Fe_2O_3)

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2 \qquad \text{Eq. (E-1)}$$

$$CO_3 + C \rightarrow 2CO \qquad \text{Eq. (E-2)}$$

M_w Fe = 55.85 g/mol

C = 12 g/mol

O = 16 g/mol

Fe_2O_3 = 159.7 g/mol

% Fe in Iron Ore (XK–01) = 55.99 %, Appendix A

% Fixed Carbon in the reductant (Dai Coal) = 40 %, Appendix A

From Eq. (E-1)

1 mol Fe_2O_3	:	3 mol CO
2 mol Fe	:	3 mol C
1 mol Fe	:	1.5 mol C

1	mol Fe	=	55.85	g Fe
55.85	g Fe	=	99.750	g of Iron ore (XK-01)
1.5	mol C	=	18	g C
18	g C	=	45	g of Reductant (Dai coal)

Iron ore : Reductant ratio from Eq. E-1 is:

g of Iron Ore	:	g of Reductant
99.750	:	45
1000	:	451.12

The other C/Fe mol ratios are calculated the same as these steps and shown in Table B-1

Table B-1 Weight Iron ore (XK–01): Reductant (Dai coal)

Mol ratio Fe	Weight Fe (g)	Weight Iron ore (g)	Mol ratio C	Weight C (g)	Weight of Reductant (g)	g Reductant/ 1000 g Iron ore
1	55.85	99.75	0.49	5.9	14.7	147.00
			1.24	14.9	37.3	374.36
			1.34	16.1	40.2	403.15
			1.44	17.2	43.1	431.95
			1.53	18.4	46.0	460.75
			1.63	19.5	48.8	489.55
			1.72	20.7	51.7	518.34
			1.82	21.8	54.6	547.14
			1.91	23.0	57.4	575.94

B.2 Mol Ratio of Limestone/ $Al_2O_3 + SiO_2$

From Raw material data Iron Ore (XK-01), Appendix A

XK–01 has % Al = 1.688

% Si = 2.276

Table B-2 Molecular Weights

Substance	M_w (g/mol)
Al	26.98
Si	28.09
Al_2O_3	101.96
SiO_2	60.08
$CaCO_3$	100.08
CaO	56.08
Bentonite	72.09
Limestone	99.31

At 1000 g XK–01:

16.88	g Al	=	0.6256	mol Al
0.6256	mol Al	=	0.3128	mol Al_2O_3
22.76	g Si	=	0.8104	mol Si
0.8104	mol Si	=	0.8104	mol SiO_2

Moles of Al_2O_3+SiO_2 = 1.12319 mol

At mol ratio Limestone/AL_2O_3+SiO_2 = 1.0

	mol Limestone	=	1.12319	mol
1.12319	mol Limestone	=	111.54	g Limestone

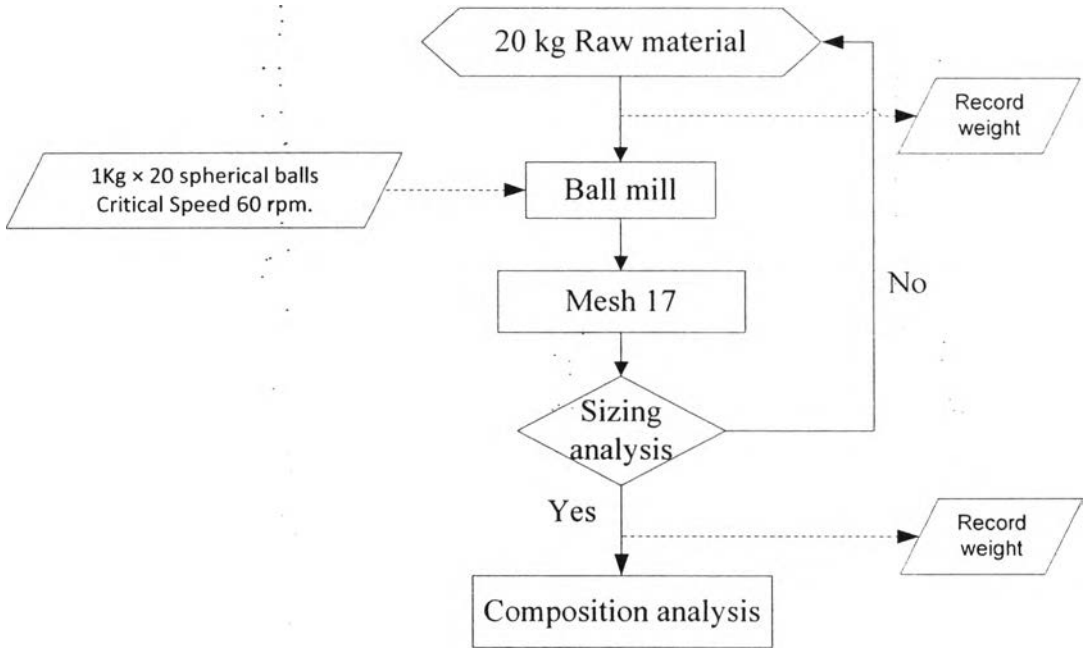
Table B-3 Weight Limestone: 1000 g Iron ore

Iron ore (g)	Dai coal at mol ratio C/Fe = 1.53 (g)	Bentonite at mol ratio Bentonite/Fe = 0.02 (g)	Mol ratio Limestone/mol AL_2O_3+SiO_2	Mol of limestone	g limestone/ kg Iron ore
1000.00	460.75	13.99	0.50	0.6	56.01
			0.60	0.7	66.93
			0.70	0.8	78.08
			0.75	0.8	84.01
			0.89	1.0	99.31
			1.00	1.1	111.54
			1.26	1.4	140.02
			1.76	2.0	196.03
			2.26	2.5	252.03

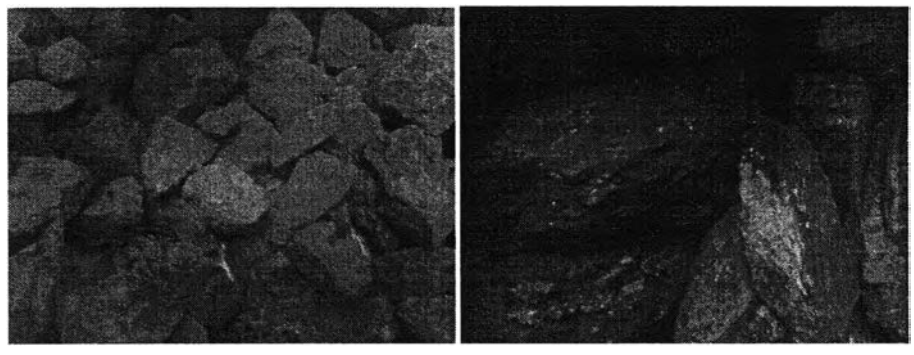
Appendix C: Sample Preparation

C.2 Grinding Raw Materials

The XK-01 iron ore and the Dai coal were grinded by a dry cylindrical ball mill in which the chamber has a diameter 70 cm and a length 100 cm. Grinding media is of the 1Kg spherical type, with 20 balls, and the critical speed was 60 rpm. Raw materials of 20 kg were added per batch. The product was screened by a mesh 17 (1.494 mm) and the oversize was grinded again. The grinding steps are shown in Figure C-1. The weight after each grinding step is tabulated in Table C-1.



FigureC-1 Grinding steps.



XK-01 Dai coal

FigureC-2 XK-01 and the Dai coal before grinding.

Table C-1 Weights from the grinding steps

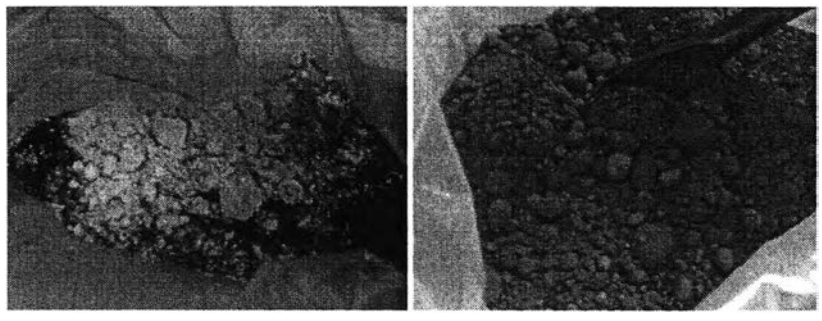
Step	Raw material	Weight (Kg)	Weight Loss (Kg)	Size
Before grinding	XK-01	79.78	-	3 cm
	Dai coal	27.5	-	3-5 cm
After grinding	XK-01	79.30	0.48	Mesh 17
	Dai coal	26.42	1.08	Mesh 17

The particle size after grinding was measured by SEM (Hitachi, model S-4800). The SEM characterization is described in Appendix A-2. The SEM accelerating voltage, current and magnification are specified in Figures E-3 and E-4 in Appendix E. The results are shown in Table A-1 in Appendix A.3.

C.3 Mixing and the Pellet Preparation

C.3.1 Amounts of the raw materials in mixtures of experiments 1–6

XK-01, Dai coal, Limestone, Bentonite were mixed where amounts of the raw materials in the mixture are shown in Table C-2. Water of 10 % by weight of the mixture was added to the mixture of the raw materials. The mixture was well mixed until a homogenous mixture was obtained. Figure C-3 shows the mixtures of the raw materials before and after the mixing.



Before After

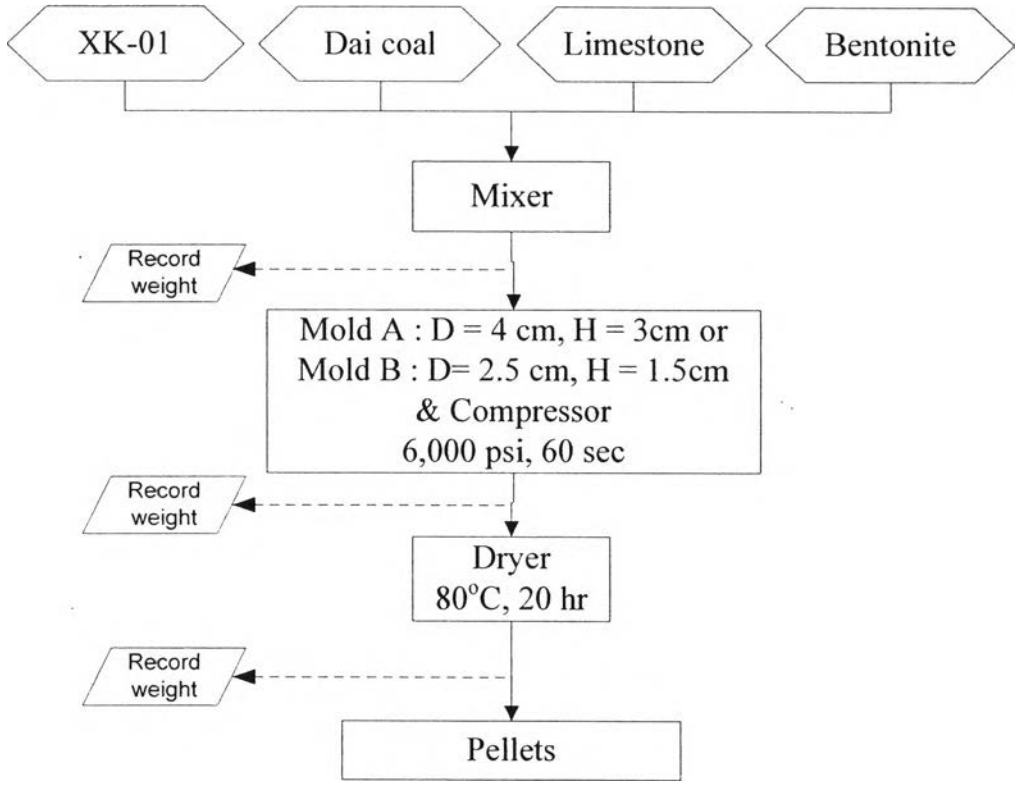
FigureC-3 Mixture of the raw materials before and after the mixing.

Table C-2 Amounts of the raw materials in the mixtures of experiments 1–6

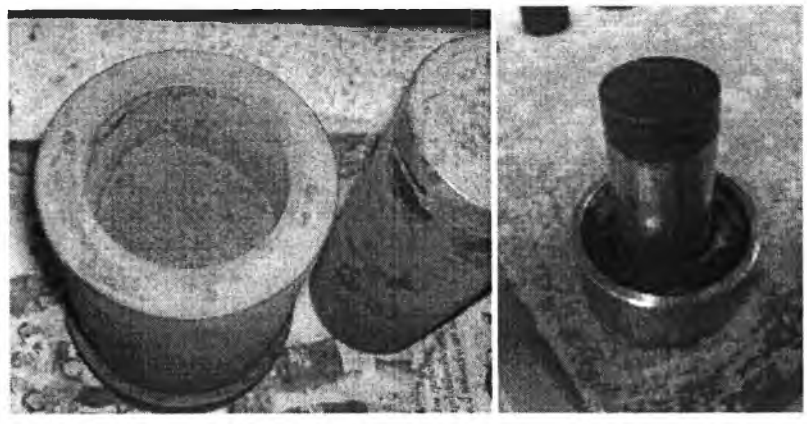
Experiment	No.	Mol ratio				Weight				Mold
		Fe	C/Fe	Limestone/Al_2O_3+SiO_2	Bentonite	XK-01 (g)	Dai coal (g)	Limestone (g)	Bentonite (g)	
1		1	0.49	0.89	0.02	1000.00	147.00	99.31	13.99	A
2		1	1.72	0.89	0.02	300.06	155.53	29.78	4.22	B
3		1	1.72	0.89	0.02	300.06	155.53	29.78	4.22	A
4		1	1.72	0.89	0.02	300.05	155.53	29.79	4.20	A
5	1	1	1.24	0.89	0.02	200.00	74.87	19.86	2.80	A
	2		1.34				80.63			
	3		1.44				86.39			
	4		1.53				92.15			
	5		1.63				97.91			
	6		1.72				103.67			
	7		1.82				109.43			
	8		1.91				115.19			
6	1	1	1.53	0.50	0.02	200.00	92.15	11.20	2.80	A
	2			0.60				13.39		
	3			0.70				15.62		
	4			0.75				16.80		
	5			0.89				19.86		
	6			1.00				22.31		
	7			1.26				28.00		
	8			1.76				39.21		
	9			2.26				50.41		

C.3.2 Pellet Preparation

The mixture was fed into a cylindrical mold (Mold A has a diameter of 4 cm and 7 cm high, Mold B has a diameter of 2.5 cm and 4 cm high) for making pellets that is shown in Figure C-5. The pellet was compressed in the mold at 6,000 psi, 60 sec and then dried at 80°C and for 20 hr. Steps of the pellet preparation are shown in Figure C-4.

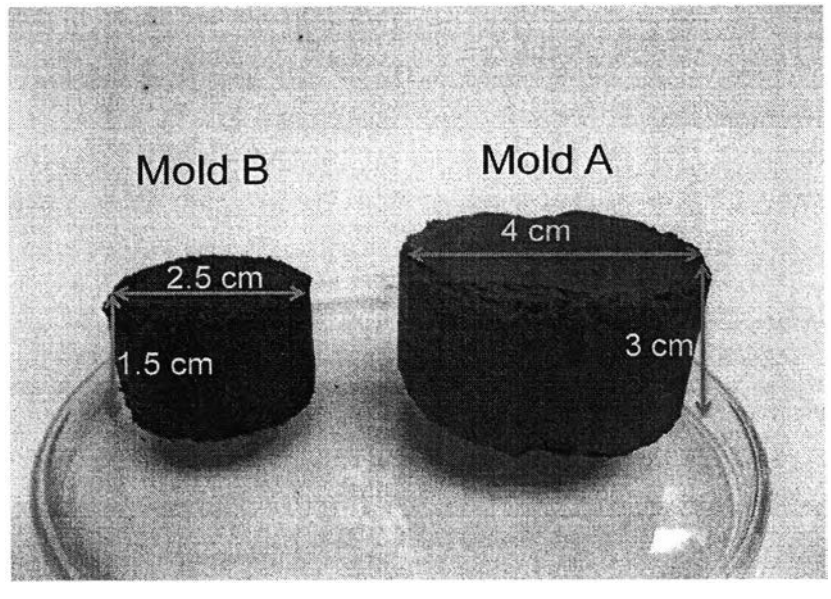


FigureC-4 Step of pellet preparation.



Mold A Mold B

FigureC-5 Cylindrical molds A and B.



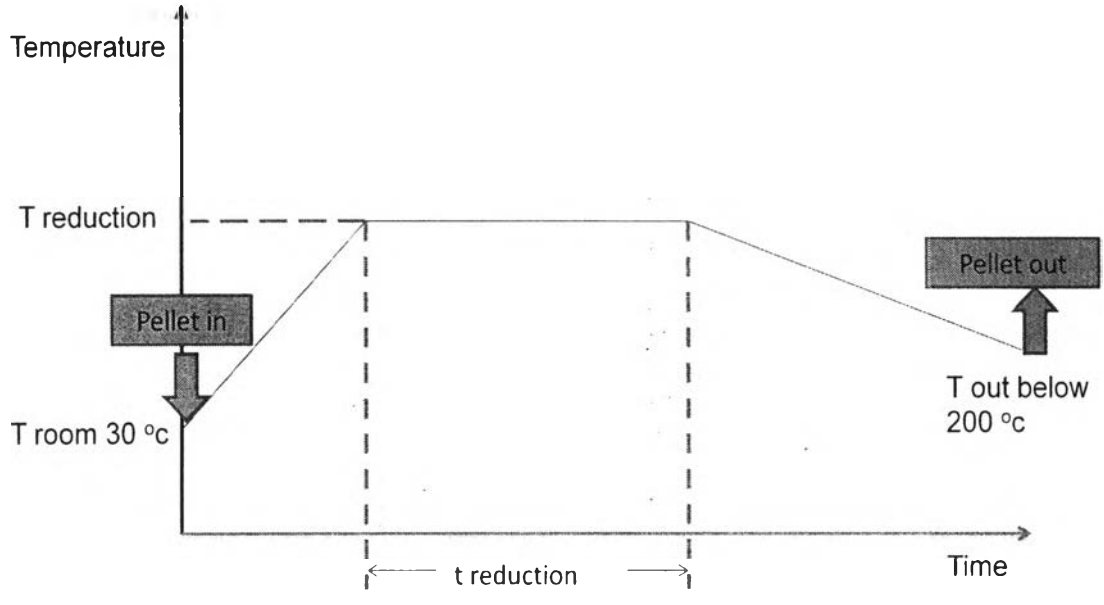
FigureC-6 Sizes of the pellets by Molds A and B.

C.3.3 Reduction

C.3.3.1 Experiments 1 and 2

All pellets of experiments 1–2 were reduced by a furnace (Nabertherm,LHT 02/17). The pellet was heated from room temperature (30°C) to the reduction temperature at a heating rate of 10 °C/min and then held on during the reduction time (Error of furnace +/- 5 °C). The temperatures profile of furnace is shown in Figure C-7. The reduction condition and weight of pellet are shown in

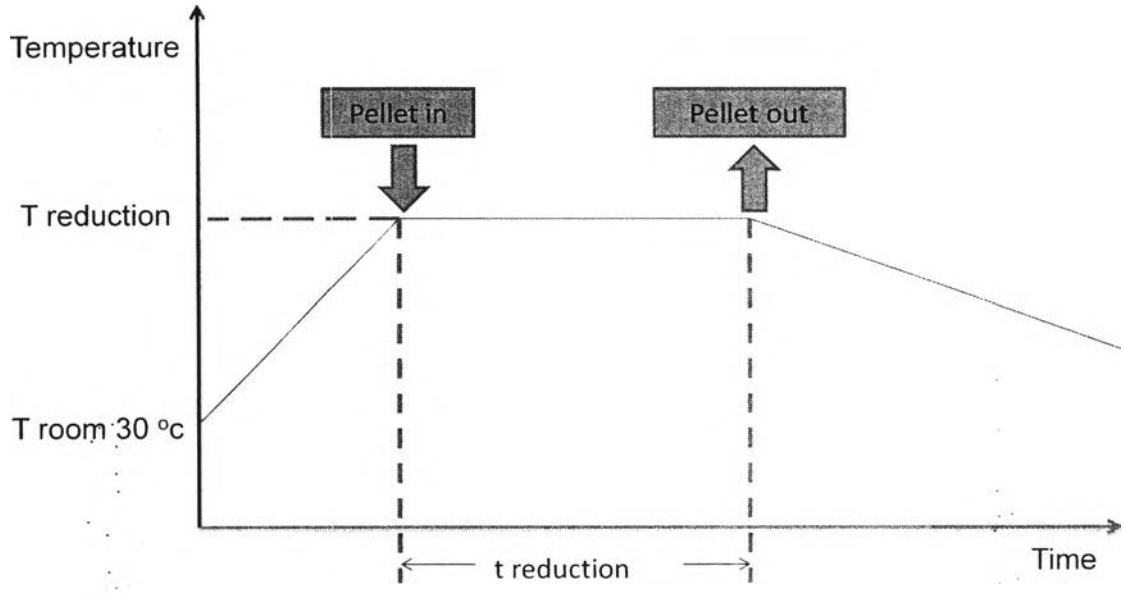
Tables C-4 and C-5. The sample was taken out from the furnace at a temperature below 200 °C.



FigureC-7 Temperature profile of furnace, experiments 1 and 2.

C.3.3.2 Experiments 3–6

The pellet was reduced in a furnace (Nabertherm,HTCT 08/15); it was fed at a reduction temperature which was held on during the reduction period. After the reduction period, the sample was taken out immediately. The temperature profile of the furnace is shown in Figure C-8. The reduction condition and weight of pellet are tabulated in Tables C-6–C-9.



FigureC-8 Temperature profile of furnace, experiments 3–6.

Table C-3 Experiment 1, the sample weight of each step in the pellet preparation and reduction through Mold A

No.	Reduction Temperature (°C)	Time (min)			Weight (1 pellet) (g)	
		Heating from room temperature (30°C)	Hold on reduction temperature	Cool down (hr)	Wet	Dried
1	1500	147	50	20	90.37	85.63
2	1400	137	50		79.00	73.76
3	1300	127	50		82.33	78.34
4	1200	117	50		89.04	84.5
5	1100	107	50		83.71	79.35
6	1000	99	50		81.35	82.78

Table C-4 Experiment 2, the weight of each step in the pellet preparation and reduction through Mold B

No.	Reduction Temperature (°C)	Time (min)			Weight (1 pellet) (g)	
		Heating from room temperature (30°C)	Hold on reduction temperature	Cool down (hr)	Wet	Dried
1	1500	147	50	20	13.22	11.58
2	1450	137	50		14.61	12.79
3	1400	127	50		14.97	12.93
4	1300	117	50		18.21	17.00
5	1200	107	50		13.25	11.98

Table C-5 Experiment 3, the weight of each step in the pellet preparation and reduction by Mold A

No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	Weight (1 pellet) (g)	
			Wet	Dried
1	1500	50	59.41	53.09
2	1450	50	59.36	53.09
3	1400	50	59.61	53.37
4	1375	50	58.43	50.73
5	1350	50	58.85	52.63
6	1300	50	59.77	53.4
7	1200	50	59.64	53.09

Table C-6 Experiment 4, the weight of each step in the pellet preparation and the reduction by Mold A

No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	Weight (1 pellet) (g)	
			Wet	Dried
1	1450	40	58.08	51.93
2	1450	30	58.66	52.59
3	1450	20	58.08	51.61
4	1450	10	58.42	52.01
5	1425	30	58.81	52.17
6	1425	20	58.08	51.61
7	1425	15	58.44	51.95
8	1425	10	57.72	51.51
9	1400	40	58.70	52.63
10	1400	35	59.12	52.35
11	1400	30	58.61	52.63
12	1375	40	57.43	51.19

Table C-7 Experiment 5, the weight of each step in the pellet preparation and the reduction by Mold A

No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	Mol ratio C/Fe	Weight (3 pellets) (g)	
				Wet	Dried
1	1425	20	1.24	176.21	155.24
2			1.34	178.96	156.19
3			1.44	176.39	159.23
4			1.53	167.54	149.90
5			1.63	169.22	150.10
6			1.72	174.45	153.05
7			1.82	174.56	152.96
8			1.91	180.07	156.35

Table C-8 Experiment 6, the weight of each step in the pellet preparation and the reduction by Mold A

No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	Mol ratio Limestone/Al_2O_3+SiO_2	Weight (3 pellets) (g)	
				Wet	Dried
1	1425	20	0.50	172.65	156.31
2			0.60	176.36	157.64
3			0.70	176.36	157.90
4			0.75	174.94	158.27
5			0.89	183.14	163.91
6			1.00	179.46	159.70
7			1.26	175.98	159.31
8			1.76	178.30	160.60
9			2.26	177.23	157.36

Table C-9 Experiment 7, the weight of each step in the pellet preparation and the reduction by Mold A

No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	Weight (3 pellet) (g)	
			Wet	Dried
1	1400	30		
2	1400	20		
3	1400	10		
4	1350	30		
5	1350	20		
6	1300	30		
7	1300	20		
8	1300	10		

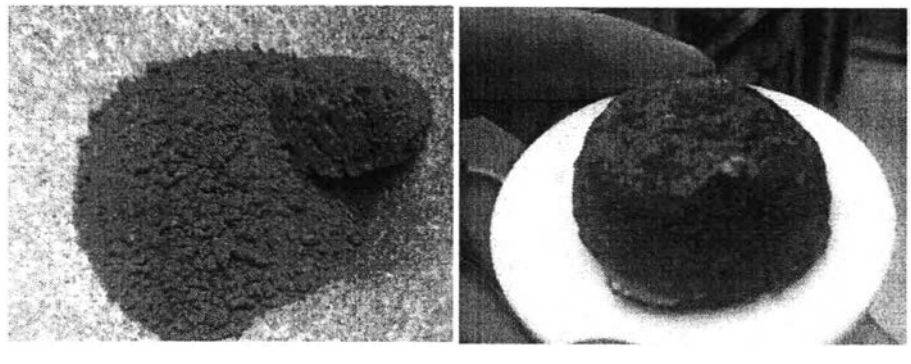
Appendix D: Result

D.1 Experiments 1

XK-01, Dai coal, Limestone, Bentonite were mixed by using mol ratio C/Fe = 0.49 (less than 1.5 from Eq.B–1 in Appendix B.) The weights of pellet after reduction are shown in Table C-1.

Table D-1 Experiment 1; the sample weight after reduction through Mold A

No.	Reduction Temperature (°C)	Time (min)			After Reduction (1 pellet) (g)
		Heating from room temperature (30°C)	Hold on reduction temperature	Cool down	
1	1500	147	50	-	51.16
2	1400	137	50	-	39.71
3	1300	127	50	-	44.45
4	1200	117	50	-	55.42
5	1100	107	50	-	53.26
6	1000	99	50	-	57.38



No. 1 No. 6

Figure D-1 Experiment 1: No. 1 and 6 after the reduction.

Products from the reduction were characterized % wt Element by EDX (Horiba, model 51-ADD0014). EDX characterization is show in Appendix A-2. Table D-2 shows the % Element of No. 1–6 in the experiment 1.

Table D-2 Experiment 1 % wt Element of No. 1-5 at reduction time 50 min

Element	% wt Element of pellet						SD					
	1	2	3	4	5	6	1	2	3	4	5	6
C	4.28	0.67	2.12	1.65	2.12	3.90	7.41	0.59	2.01	2.42	0.91	1.00
O	27.54	29.59	21.48	26.91	25.77	22.86	3.25	1.33	2.68	1.47	0.77	0.76
Al	4.68	4.99	2.54	2.13	1.24	1.14	0.89	0.71	0.74	0.41	0.10	0.06
Si	3.16	4.60	4.23	5.00	3.15	2.44	0.62	1.20	0.23	0.51	0.29	0.27
K	0.06	0.16	0.22	0.38	0.21	0.08	0.06	0.15	0.04	0.09	0.04	0.05
Fe	53.45	51.81	62.90	54.54	60.75	62.35	2.86	1.08	3.35	3.20	1.30	0.47
Zr	0.81	0.00	0.17	0.00	0.48	0.46	1.40	N/A	0.30	N/A	0.25	0.01
Mn	0.00	0.00	0.00	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A	N/A
Ca	4.82	6.54	5.29	7.28	5.26	5.68	1.46	1.05	0.38	0.92	0.33	0.50
Ti	0.00	0.00	0.00	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A	N/A
Au	0.00	0.00	0.00	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A	N/A
Cu	0.18	0.00	0.19	0.00	0.04	0.05	0.31	N/A	0.34	N/A	0.07	0.07
P	0.73	1.51	0.62	1.25	0.67	0.86	0.38	0.45	0.16	0.13	0.40	0.04
S	0.30	0.14	0.24	0.33	0.15	0.10	0.29	0.05	0.11	0.09	0.08	0.00
Mg	0.00	0.00	0.06	0.14	0.00	0.05	N/A	N/A	0.05	0.11	0.00	0.07
Na	0.00	0.00	0.00	0.41	0.17	0.04	N/A	N/A	N/A	0.12	0.19	0.06
Cl	0.00	0.00	0.00	0.00	0.00	0.00	N/A	N/A	N/A	0.04	N/A	N/A

% Fe of experiment 1, No. 1–6 is shown vs. the reduction temperature at the 50 min reduction time in Figures D-2.

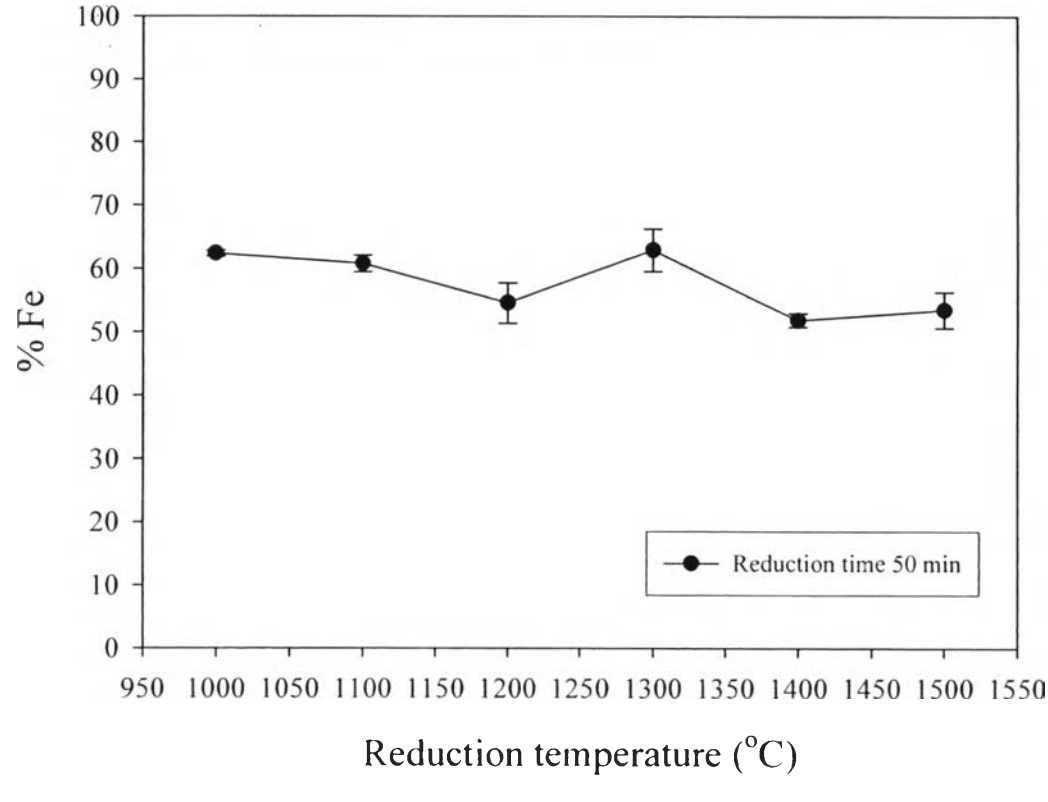


Figure D-2 Experiment 1 graph of % Fe vs. reduction temperature (Mold A).

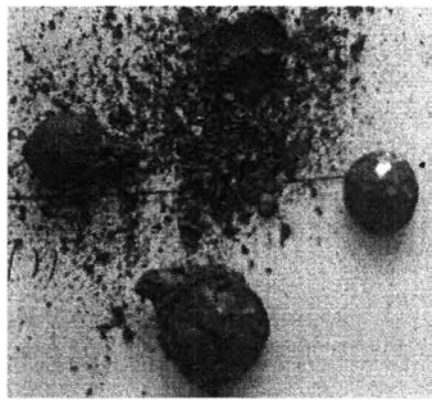
From experiment 1, with the reduction temperature of 1300°C. and at 50 min, it yields 62.90 % Fe. With increasing or decreasing reduction temperature, % Fe after reduction changes slightly. Then % Fe is independent of the reduction temperature, with the mol ratio of mixture C/Fe = 0.49, Limestone/Al_2O_3+SiO_2 = 0.89, Bentonite/Fe = 0.02 and Mold A which has a diameter of 4 cm and 7 cm high.

D.2 Experiments 2

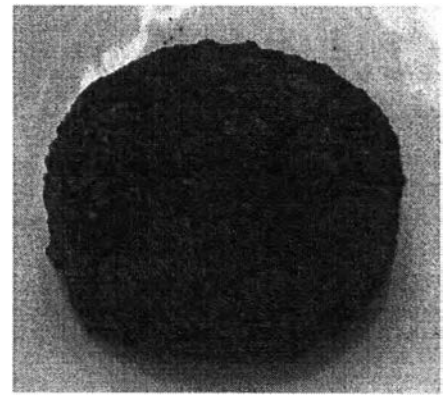
To improve productivity of Iron Nuggets from experiment 1, uses increased the mol ratio C/Fe of mixture from 0.49 to 1.72 and reduce size of pellet from mold A which has a diameter of 4 cm and 7 cm high to mold B which has a diameter of 2.5 cm and 4 cm high. The weights of pellet after reduction are shown in Table D-3.

Table D-3 Experiment 2; the weight of No. 1–5 after reduction through Mold B

No.	Reduction Temperature (°C)	Time (min)			After Reduction (1 pellet) (g)	
		Heating from room temperature (30°C)	Hold on reduction temperature	Cool down (hr)	Iron nugget	Slag
1	1500	147	50	20	4.16	0.85
2	1450	137	50		2.65	3.14
3	1400	127	50		5.15	
4	1300	117	50		9.15	
5	1200	107	50		6.67	



No. 1 1500°C, 50 min
Iron nugget size = 6.58–11.71 mm



No. 5 1200°C, 50 min

Figure D-3 Experiment 2: the pellet after the reduction.

Products from the reduction were characterized % wt Element by EDX; characterization is shown in Appendix A-2. Table D-2 shows the % Element of No. 1-5 in the experiment 2. % Fe of experiment 2 is shown vs. the reduction temperature at the 50 min reduction time in Figures D-4.

Table D-4 Experiment 2 % wt Element of No. 1–5 at reduction time 50 min

Element	% wt Element of No. 1–5							SD						
	1		2		3	4	5	1		2		3	4	5
	Iron nugget	slag	Iron nugget	slag				Iron nugget	slag	Iron nugget	slag			
C	1.83	2.74	1.85	35.81	3.77	8.45	0	0.28	3.04	0.51	17.68	1.97	4.00	N/A
O	1.71	28.02	0.00	19.60	11.83	12.70	26.39	1.11	2.08	N/A	3.11	2.22	0.76	0.17
Al	0.22	11.38	0.00	2.65	1.04	1.14	1.73	0.03	1.02	N/A	0.75	0.16	0.34	0.18
Si	0.4	10.03	0.00	3.88	2.10	2.09	3.66	0.07	0.52	N/A	2.13	0.12	0.46	0.23
K	0.00	1.88	0.00	0.18	0.33	0.36	0.82	N/A	0.67	N/A	0.04	0.09	0.12	0.04
Fe	92.9	24.12	95.5	22.34	76.28	70.02	61.21	1.92	3.36	0.36	8.83	1.38	3.28	0.05
Zr	0.65	1.07	0.00	0.35	1.48	0.52	0.22	0.21	1.51	N/A	0.44	0.20	0.22	0.38
Mn	0.00	0.00	0.00	0.00	0.00	0.04	0.00	N/A	N/A	N/A	N/A	N/A	0.06	N/A
Ca	0.07	19.97	0.00	12.61	2.41	3.91	4.56	0.06	4.21	N/A	4.24	0.14	0.88	0.21
Ti	0.00	0.22	0.00	0.10	0.00	0.02	0.00	N/A	0.25	N/A	0.17	N/A	0.03	N/A
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cu	0.16	0.00	0.00	0.00	0.05	0.02	0.00	0.27	N/A	N/A	N/A	0.05	0.04	N/A
P	0.28	0.24	1.67	0.00	0.00	0.17	0.26	0.15	0.31	0.27	0.00	N/A	0.17	0.26
S	1.64	0.12	0.97	2.48	0.52	0.54	0.85	0.58	0.15	0.03	1.09	0.14	0.10	0.15
Mg	0.16	0.04	0.00	0.00	0.08	0.04	0.20	0.27	0.04	N/A	N/A	0.04	0.02	0.34
Na	0.00	0.18	0.00	0.00	0.13	0.00	0.10	N/A	0.16	N/A	N/A	0.03	N/A	0.18
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A

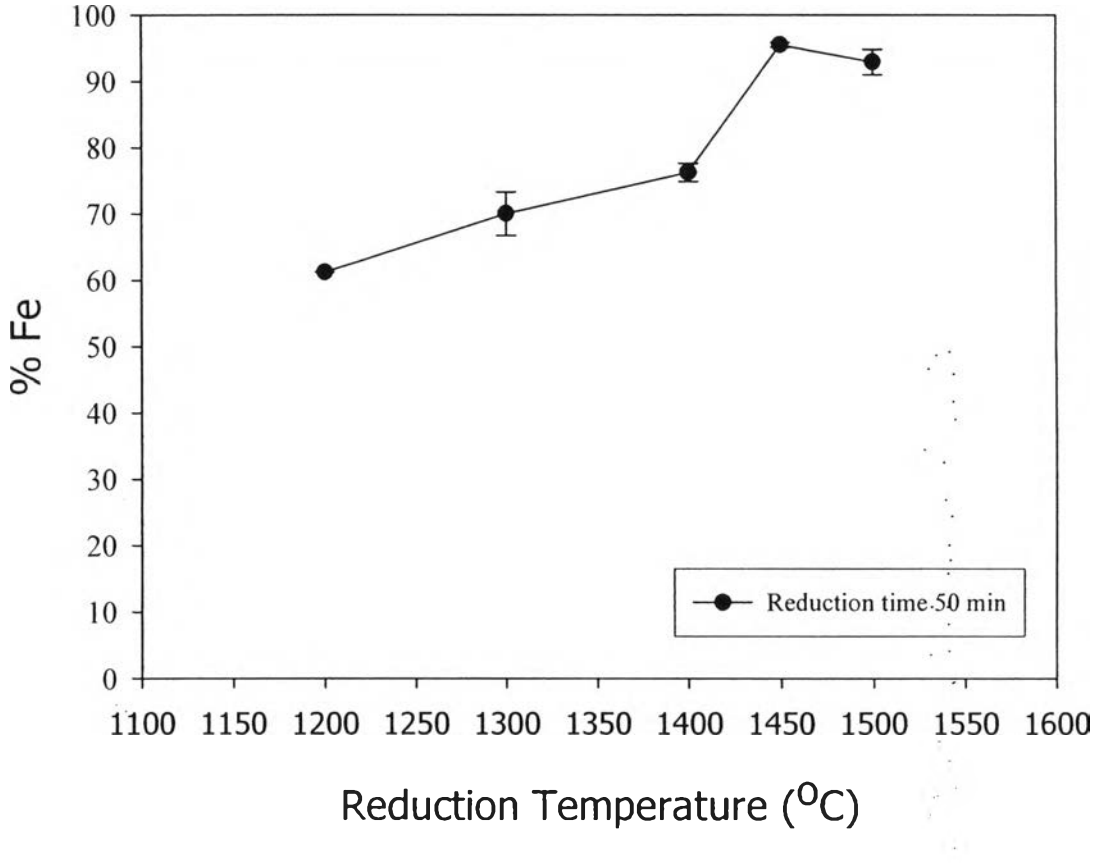


Figure D-4 Experiment 2:% Fe vs. reduction temperature (Mold B).

From experiment 2,the metal and slag separate perfectly at the reduction temperature between 1450-1500°C and at 50 min with mol ratio of mixture C/Fe = 1.72 (more than 1.5 from Eq.E–1 in Appendix E.), Limestone/Al_2O_3+SiO_2 = 0.89 and Bentonite/Fe = 0.02 and Mold B which has a diameter of 2.5 cm and 4 cm high. The sizes of Iron nuggets are small (less than 1 cm) because of using the smaller pellets from Mold B. The % yield of No. 1–5 is shown in Table D-5.

Table D-5 Experiment 2; % yield vs. reduction temperature after the reduction of Iron nuggets

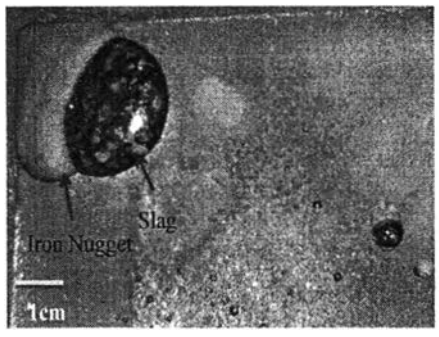
No.	%wt Iron Ore in mixture	%wt Fe in mixture	Dried Weight of pellet (g)	Fe In put (g)	% Fe Nugget from EDX	Iron nugget (g)	Fe Output (g)	% Yield
1	61.288	34.32	11.58	3.97	92.90	4.03	3.74	94.20
2			12.79	4.39	95.50	2.65	2.53	57.65
3			12.93	4.44	-	-	-	-
4			17.00	5.83	-	-	-	-
5			11.98	4.11	-	-	-	-

D.3 Experiment 3

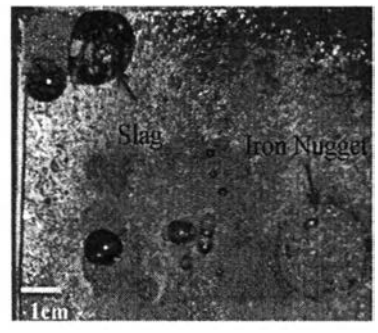
Experiment 3 using mold A to making pellets for increase size of Iron nugget from experiment 2. The weights of pellet after reduction are shown in Table D-6.

Table D-6 Experiment 3; the weight of No. 1–7 after reduction through Mold A

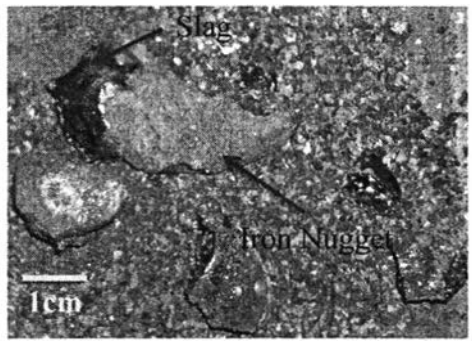
No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	After Reduction (1 pellet) (g)	
			Iron nugget	Slag
1	1500	50	19.63	6.83
2	1450	50	19.75	5.21
3	1400	50	18.38	11.65
4	1375	50	24.78	
5	1350	50	27.26	
6	1300	50	24.00	
7	1200	50	28.53	



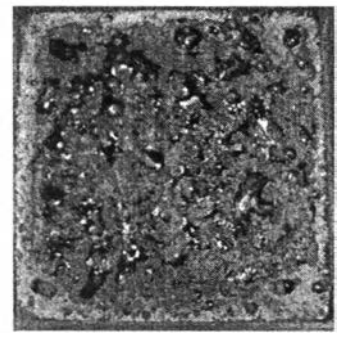
No. 1 1500°C, 50 min
Iron nugget size = 1.43–2.97 cm
Slag Size= 2.01–2.49 cm



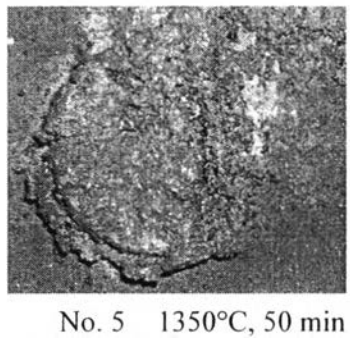
No. 2 1450°C, 50 min
Iron nugget size = 0.45–2.03 cm
Slag size = 0.78–1.66 cm



No. 3 1400°C, 50 min
Iron nugget size = 0.51–2.35 cm
Slag size = 0.65–1.38 cm

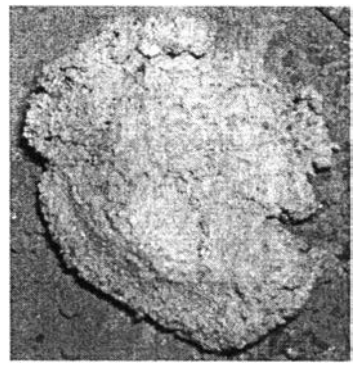


No. 4 1375°C, 50 min



No. 5 1350°C, 50 min

No. 6 1300°C, 50 min



No. 7 1200°C, 50 min

Figure D-5 Experiment 3: the pellet after the reduction.

Products from the reduction were characterized % wt Element by EDX; characterization is show in Appendix A-2. Table D-7 shows the % Element of No. 1–7 in the experiment 3. % Fe of experiment 3 is shown vs. the reduction temperature at the 50 min reduction time in Figures D-5.

Table D-7 Experiment 3; % wt Element of No. 1–7 at the reduction time 50 min

Element	% wt Element of No. 1–7										SD									
	1		2		3		4	5	6	7	1		2		3		4	5	6	7
	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag					Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag				
C	3.68	3.07	7.05	0.00	2.58	0.64	1.60	4.44	0.52	1.46	0.37	5.06	0.35	0.00	0.47	1.11	0.47	2.11	0.16	0.06
O	1.12	34.65	1.00	35.85	2.26	36.77	12.29	14.72	13.84	15.19	0.33	4.09	0.57	1.07	0.86	1.23	1.20	1.73	1.24	1.02
Al	0.03	6.97	0.01	8.68	0.01	7.77	1.44	0.88	1.04	0.72	0.05	0.22	0.01	1.77	0.02	0.48	0.43	0.24	0.51	0.26
Si	0.01	14.99	0.00	16.59	0.13	17.82	2.89	1.35	1.84	1.42	0.02	2.33	0.00	2.10	0.07	0.76	1.35	0.50	1.00	0.52
K	0.00	0.55	0.00	0.93	0.00	0.58	0.27	0.17	0.12	0.10	0.00	0.37	0.00	0.30	0.00	0.11	0.08	0.10	0.11	0.05
Fe	93.09	6.72	90.20	2.70	92.15	4.13	74.02	74.04	77.32	77.00	0.71	4.62	1.36	0.44	0.73	3.59	3.28	3.44	5.35	3.37
Zr	0.31	0.10	0.23	0.90	0.21	0.09	0.41	0.23	0.37	0.00	0.35	0.18	0.40	1.56	0.37	0.16	0.17	0.25	0.46	0.00
Mn	0.00	0.17	0.00	0.22	0.00	0.11	0.03	0.00	0.00	0.00	0.00	0.19	0.00	0.16	0.00	0.19	0.05	0.00	0.00	0.00
Ca	0.07	31.20	0.04	32.85	0.17	30.42	5.39	3.52	4.10	3.50	0.02	10.04	0.07	1.84	0.07	0.83	1.53	0.91	2.26	1.36
Ti	0.00	0.46	0.00	0.43	0.00	0.52	0.02	0.00	0.00	0.00	0.00	0.27	0.00	0.23	0.00	0.04	0.04	0.00	0.00	0.00
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.23	0.06	0.19	0.00	0.06	0.00	0.13	0.00	0.07	0.00	0.20	0.11	0.17	0.00	0.10	0.00	0.06	0.00	0.13	0.00
P	0.76	0.00	0.65	0.00	1.14	0.09	0.64	0.10	0.20	0.37	0.22	0.00	0.15	0.00	0.20	0.16	0.37	0.18	0.18	0.25
S	0.69	0.58	0.63	0.29	1.29	0.49	0.68	0.50	0.55	0.21	0.05	0.20	0.11	0.09	0.17	0.08	0.02	0.18	0.50	0.03
Mg	0.00	0.38	0.00	0.43	0.00	0.54	0.08	0.03	0.02	0.00	0.00	0.20	0.00	0.10	0.00	0.05	0.04	0.06	0.03	0.00
Na	0.00	0.08	0.00	0.14	0.00	0.02	0.10	0.00	0.00	0.04	0.00	0.13	0.00	0.09	0.00	0.03	0.02	0.00	0.00	0.04
Cl	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

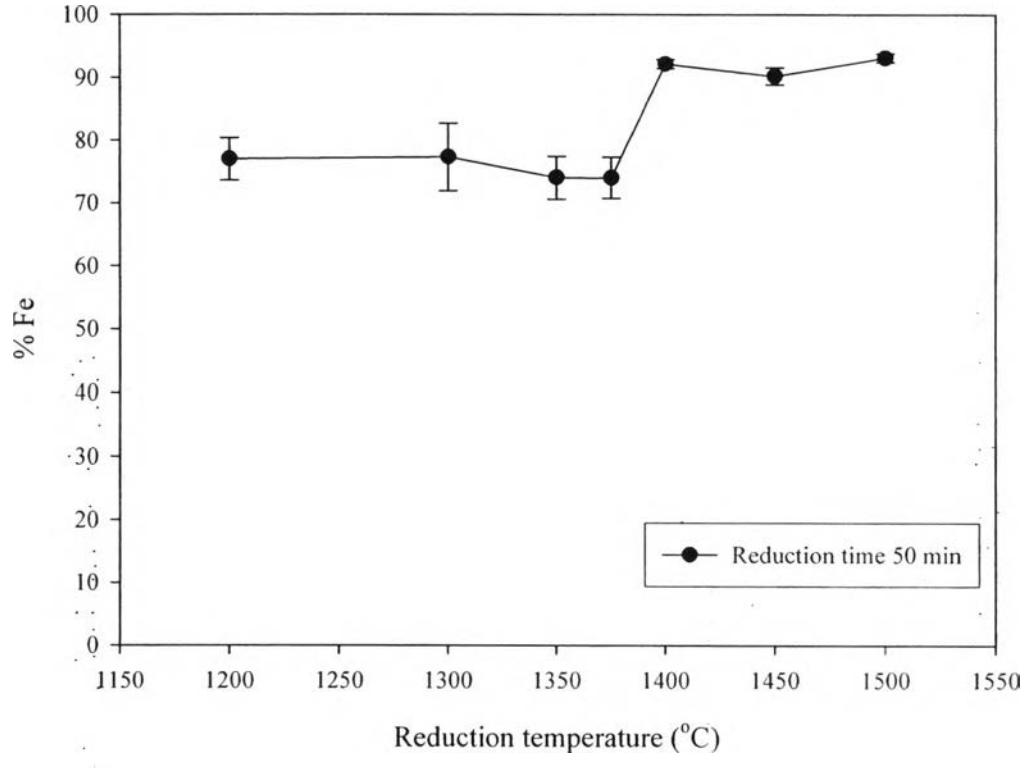


Figure D-6 Experiment 3 graph of % Fe vs. reduction temperature (Mold A).

From experiment 3,the metal and slag separate perfectly at the reduction temperature between 1450–1500°C at 50 min, with the mol ratio of mixture C/Fe = 1.72 (more than 1.5 from Eq.E-1 in appendix E.), Limestone/Al_2O_3+SiO_2 = 0.89 and Bentonite = 0.02/Fe and Mold A which has a diameter of 2.5 cm and 4 cm high. The % yield of No. 1–7 is shown in Table D-8.

Table D-8 Experiment 3; % yield vs. reduction temperature after the reduction of Iron nuggets

No.	%wt Iron Ore in mixture	%wt Fe in mixture	Dried Weight of pellet (g)	Fe In put (g)	% Fe Nugget from EDX	Iron nugget (g)	Fe Output (g)	% Yield
1	61.288	34.32	53.09	18.22	93.09	19.63	18.27	100.29
2			53.09	18.22	90.20	19.75	17.81	97.77
3			53.37	18.32	92.15	18.38	16.94	92.46
4			50.73	17.41	-	-	-	-
5			52.63	18.06	-	-	-	-
6			53.40	18.33	-	-	-	-
7			53.09	18.22	-	-	-	-

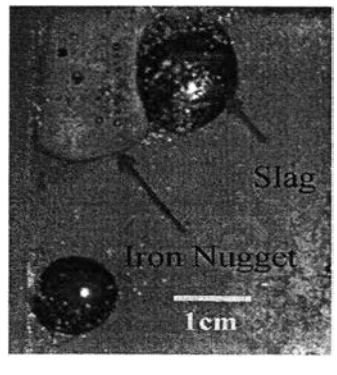
The % yield after reduction of No. 1 is over 100 % because other raw materials have iron contents (Dai coal has % Fe = 2.25 and Bentonite has % Fe = 3.56) and errors from the measurements.

D.4 Experiment 4

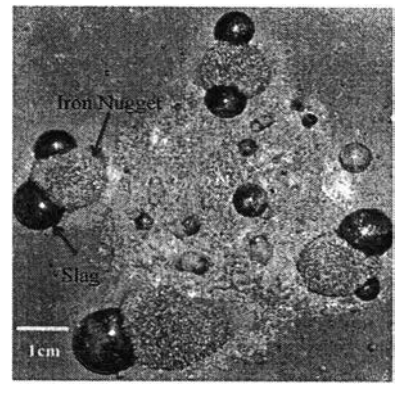
The reduction time and reduction temperature were varied to determine suitable conditions for the iron nugget production. The weights of pellet after reduction are shown in Table D-9.

Table D-9 Experiment 4; the weight of No. 1–12 after reduction through Mold A

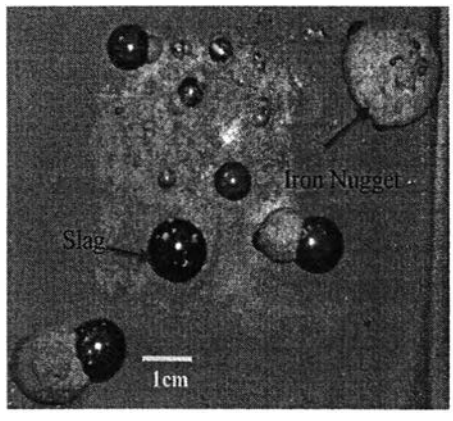
No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	After Reduction (1 pellet) (g)	
			Iron nugget	Slag
1	1450	40	16.68	7.11
2	1450	30	18.51	8.24
3	1450	20	17.54	8.70
4	1450	10	17.96	9.57
5	1425	30	17.90	8.77
6	1425	20	17.30	10.47
7	1425	15	17.20	7.16
8	1425	10	26.86	
9	1400	40	15.92	8.88
10	1400	35	27.11	
11	1400	30	26.73	
12	1375	40	26.29	



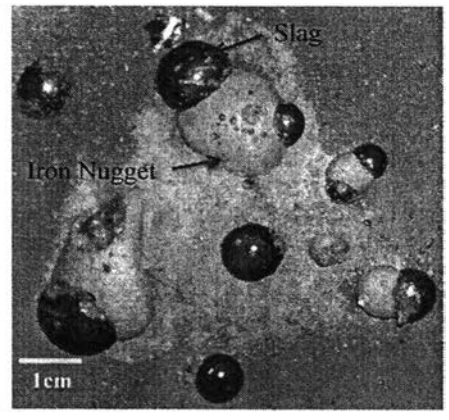
No. 1 1450°C, 40 min
Iron nugget size = 0.48–2.49 cm
Slag size = 0.33–1.90 cm



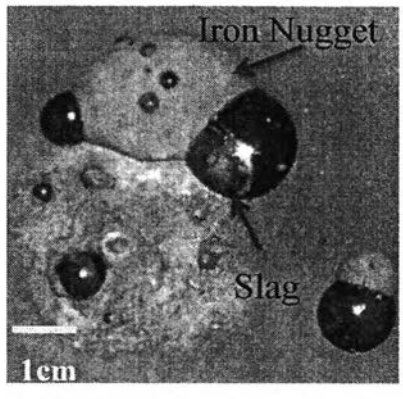
No. 2 1450°C, 30 min
Iron nugget size = 1.24–2.12 cm
Slag size = 0.56–1.18 cm



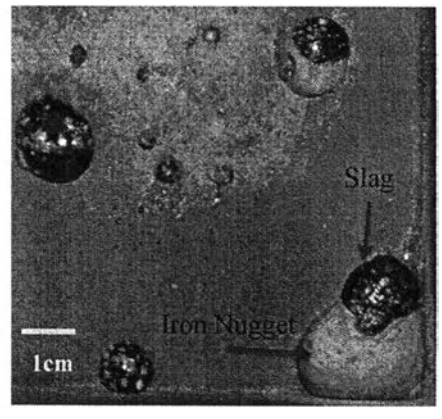
No. 3 1450°C, 20 min
Iron nugget size = 0.21–1.92 cm
Slag size = 0.81–1.20 cm



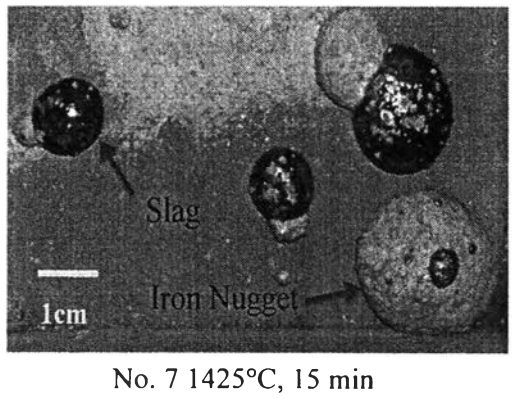
No. 4 1450°C, 10 min
Iron nugget size = 0.67–1.96 cm
Slag size = 0.44–1.14 cm



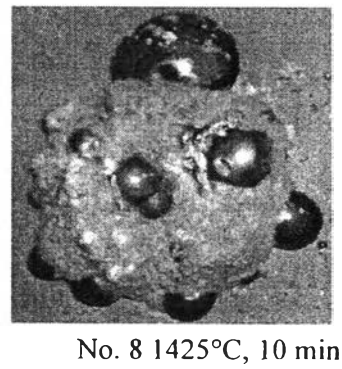
No. 5 1425°C, 30 min
Iron nugget size = 0.56–2.23 cm
Slag size = 0.68–1.48 cm



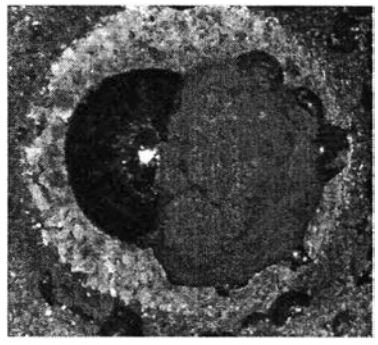
No. 6 1425°C, 20 min
Iron nugget size = 1.22–2.37 cm
Slag size = 0.72–1.36 cm



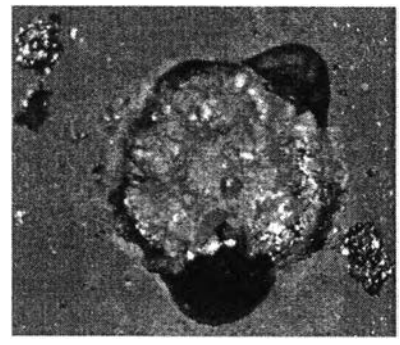
No. 7 1425°C, 15 min
Iron nugget size = 0.54 –2.32 cm
Slag size = 0.41–1.06 cm



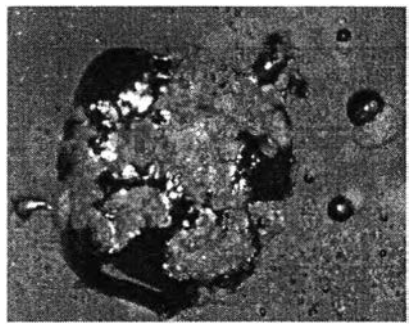
No. 8 1425°C, 10 min



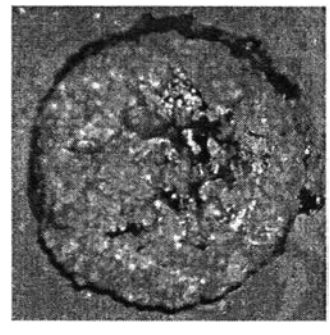
No. 9 1400°C, 40 min



No. 10 1400°C, 35 min



No. 11 1400°C, 30 min



No. 12 1375°C, 40 min

Figure D-7 Experiment 4: the pellet after the reduction.

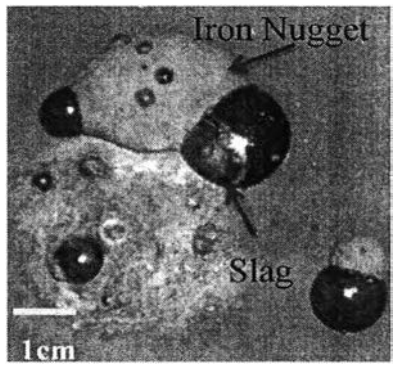
Products from the reduction were characterized % wt Element by EDX; characterization is shown in Appendix A-2. Table D-10 shows the % Element of No. 1–12 in the experiment 4.

Table D-10 Experiment 4 % wt Element of No. 1–12

Element	% wt Element of No. 1–12																				
	1		2		3		4		5		6		7		8	9		10	11		12
	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag		Iron nugget	Slag		Iron nugget	Slag	
C	2.98	1.07	8.31	0.68	2.36	2.33	3.11	1.51	2.03	1.33	2.77	1.36	1.85	1.36	1.92	2.50	16.94	1.28	1.60	17.03	2.98
O	1.73	25.94	0.11	32.45	1.63	34.06	0.00	31.38	0.21	34.71	0.60	33.54	1.92	33.54	7.58	2.28	23.17	5.29	1.74	27.04	8.57
Al	0.56	6.90	0.12	7.41	0.41	7.32	0.06	7.22	0.08	7.68	0.21	7.19	0.49	7.19	0.98	0.09	4.97	0.41	0.53	5.25	2.18
Si	0.83	16.23	0.00	17.64	0.88	17.23	0.22	17.13	0.19	17.56	0.40	16.87	1.05	16.87	0.84	0.10	11.21	0.81	0.50	11.16	4.01
K	0.00	5.85	0.00	1.26	0.01	1.40	0.00	1.33	0.00	1.42	0.00	1.44	0.04	1.44	0.07	0.00	1.39	0.23	0.06	1.12	0.34
Fe	92.13	3.51	89.92	4.23	92.06	4.14	94.49	6.18	95.67	3.48	93.95	7.04	91.86	7.04	85.72	91.45	19.94	88.94	92.65	13.77	74.14
Zr	0.00	0.18	0.00	0.09	0.00	0.46	0.00	0.37	0.00	0.92	0.00	0.38	0.00	0.38	0.23	0.00	0.09	0.21	0.19	0.23	0.57
Mn	0.00	0.14	0.00	0.37	0.00	0.25	0.00	0.39	0.00	0.12	0.00	0.31	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.14	0.00
Ca	0.18	38.55	0.01	34.44	0.62	31.34	0.07	29.56	0.05	31.27	0.23	30.57	0.64	30.57	0.92	0.37	19.33	0.69	1.11	20.76	6.14
Ti	0.00	0.64	0.00	0.57	0.00	0.53	0.00	4.09	0.00	0.57	0.00	0.53	0.00	0.53	0.00	0.00	0.35	0.00	0.00	0.35	0.00
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.15	0.00	0.08	0.00	0.19	0.00	0.37	0.00	0.11	0.00	0.18	0.00	0.15	0.00	0.13	0.00	0.00	0.31	0.10	0.00	0.03
P	0.81	0.00	0.78	0.00	0.99	0.00	0.92	0.00	0.95	0.00	0.93	0.00	1.05	0.00	0.31	1.40	0.73	0.50	0.50	0.52	0.22
S	0.64	0.36	0.56	0.26	0.83	0.20	0.76	0.15	0.72	0.22	0.72	0.12	0.83	0.12	0.75	1.81	1.60	1.29	0.99	2.26	0.46
Mg	0.00	0.36	0.10	0.47	0.02	0.46	0.00	0.44	0.00	0.50	0.00	0.44	0.07	0.44	0.51	0.00	0.27	0.00	0.01	0.23	0.19
Na	0.00	0.21	0.00	0.15	0.00	0.27	0.00	0.27	0.00	0.21	0.00	0.21	0.02	0.21	0.03	0.00	0.02	0.04	0.00	0.14	0.00
Cl	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17

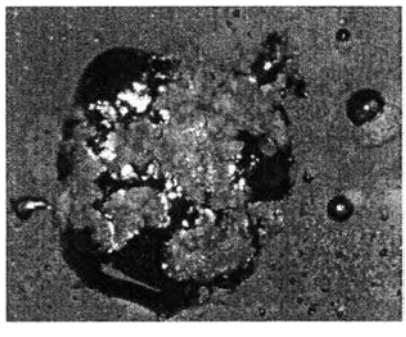
Element	SD																				
	1		2		3		4		5		6		7		8	9		10	11		12
	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag		Iron nugget	Slag		Iron nugget	Slag	
C	1.09	1.64	0.20	1.18	0.25	4.04	0.64	2.62	0.22	1.18	0.15	2.36	0.37	2.36	1.07	0.53	15.57	1.05	0.86	1.28	0.68
O	0.20	4.27	0.19	0.91	0.68	3.66	0.00	2.64	0.19	2.89	0.13	8.14	0.88	8.14	1.35	0.19	7.22	0.47	1.34	1.96	2.14
Al	0.08	0.62	0.10	0.16	0.22	0.82	0.03	0.56	0.04	0.38	0.07	0.73	0.19	0.73	0.52	0.04	1.48	0.12	0.42	0.88	0.28
Si	0.34	1.15	0.00	0.34	0.46	1.94	0.03	1.36	0.01	0.71	0.10	1.32	0.44	1.32	0.56	0.03	2.85	0.28	0.22	2.30	0.49
K	0.00	7.51	0.00	0.07	0.02	0.07	0.00	0.19	0.00	0.13	0.00	0.22	0.04	0.22	0.13	0.00	0.94	0.13	0.11	0.38	0.02
Fe	1.07	0.80	0.60	0.62	1.41	1.30	0.93	2.39	0.20	1.23	0.30	1.58	1.80	1.58	2.42	0.53	2.22	1.08	0.07	2.83	3.60
Zr	0.00	0.31	0.00	0.15	0.00	0.79	0.00	0.64	0.00	1.31	0.00	0.66	0.00	0.66	0.21	0.00	0.15	0.18	0.17	0.20	0.32
Mn	0.00	0.24	0.00	0.08	0.00	0.16	0.00	0.15	0.00	0.21	0.00	0.11	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Ca	0.14	4.81	0.02	1.22	0.41	1.38	0.07	6.96	0.05	1.01	0.02	5.46	0.26	5.46	0.69	0.10	8.26	0.12	0.72	1.63	0.91
Ti	0.00	0.23	0.00	0.01	0.00	0.02	0.00	6.05	0.00	0.08	0.00	0.07	0.00	0.07	0.00	0.00	0.17	0.00	0.00	0.07	0.00
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.12	0.00	0.07	0.00	0.06	0.00	0.10	0.00	0.09	0.00	0.05	0.00	0.19	0.00	0.12	0.00	0.00	0.14	0.07	0.00	0.03
P	0.25	0.00	0.18	0.00	0.12	0.00	0.19	0.00	0.18	0.00	0.02	0.00	0.07	0.00	0.04	0.15	0.69	0.14	0.17	0.66	0.27
S	0.12	0.24	0.07	0.03	0.03	0.05	0.09	0.13	0.13	0.04	0.03	0.11	0.10	0.11	0.29	0.27	0.61	0.29	0.53	0.49	0.19
Mg	0.00	0.10	0.17	0.02	0.03	0.05	0.00	0.03	0.00	0.04	0.00	0.06	0.06	0.06	0.88	0.00	0.16	0.00	0.02	0.06	0.07
Na	0.00	0.04	0.00	0.01	0.00	0.03	0.00	0.09	0.00	0.05	0.00	0.16	0.04	0.16	0.06	0.00	0.04	0.06	0.00	0.12	0.00
Cl	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15

From Experiments 3–4, we can classify the type of separation into 3 types as shown in Figure C-4. The % yield of each pellet is shown in Table C-2.



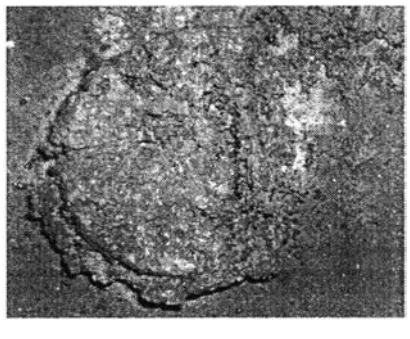
Complete separation:
The Iron was reduced completely. The metal and slag separate perfectly.

Experiment 4
No. 5 1425°C, 30 min
Iron nugget size = 0.56–2.23 cm
Slag size = 0.68–1.48 cm



Partial separation:
The metal and slag separate partially.

Experiment 4
No. 11 1400°C, 30 min



Direct reduction:
The Iron reduction was not yet complete. The metal and slag are not separated.

Experiment 3
No. 5 1350°C, 50 min

Figure D-8 Type of separation.

Table D-11 Experiment 4 % yield after reduction of Iron nuggets

No.	%wt Iron Ore in mixture	%wt Fe in mixture	Dried Weight of pellet (g)	Fe In put (g)	% Fe Nugget from EDX	Iron nugget (g)	Fe Output (g)	% Yield	Separation Status
1	61.29	34.32	51.93	17.82	92.13	16.68	15.37	86.22	Complete
2			52.59	18.05	89.92	18.51	16.64	92.21	Complete
3			51.61	17.71	92.06	17.54	16.15	91.16	Complete
4			52.01	17.85	94.49	17.96	16.97	95.07	Complete
5			52.17	17.91	95.67	17.90	17.12	95.64	Complete
6			51.61	17.71	93.95	17.30	16.25	91.76	Complete
7			51.95	17.83	91.86	17.20	15.80	88.61	Complete
8			51.51	17.68	-	-	-	-	Partial
9			52.63	18.06	91.45	15.92	14.56	80.60	Complete
10			52.35	17.97	-	-	-	-	Partial
11			52.43	17.99	-	-	-	-	Partial
12			51.19	17.57	-	-	-	-	Direct reduction

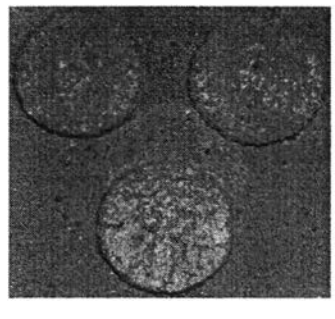
From Experiments 3–4, the suitable conditions for making Iron nugget at % yield more than 90 % are from using the mol ratio of mixture C/Fe = 1.72 (more than 1.5 from Eq.E–1 in Appendix E.), Limestone/Al_2O_3+SiO_2 = 0.89 and Bentonite/Fe = 0.02 and Mold A which has a diameter of 2.5 cm and 4 cm high with the reduction temperature 1425°C, and at 20 min reduction time.

D.5 Experiment 5

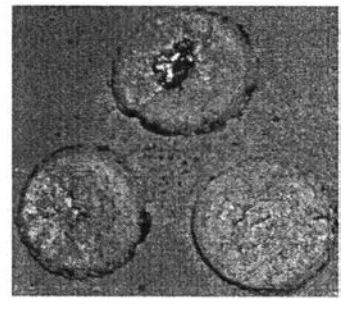
All pellets were reduced at the reduction temperature 1425°C and the reduction time of 20 min. Experiment 5, the mol ratio C/Fe of mixture was varied to minimize the Dai coal usage. The weights of No. 1–8 after the reduction are shown in Table D-12.

Table D-12 Experiment 5; the weight of No.1–8 after the reduction through Mold A

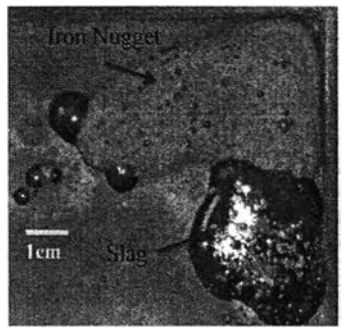
No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	mol ratio C/Fe	After Reduction (3 pellets) (g)	
				Iron nugget	Slag
1	1425	20	1.24	84.05	
2			1.34	82.54	
3			1.44	61.92	21.79
4			1.53	57.60	19.29
5			1.63	54.72	18.62
6			1.72	52.51	20.47
7			1.82	49.20	25.36
8			1.91	52.69	16.26



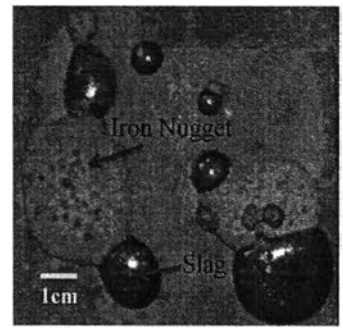
No. 1 1425°C, 20 min
C/Fe = 1.24/1



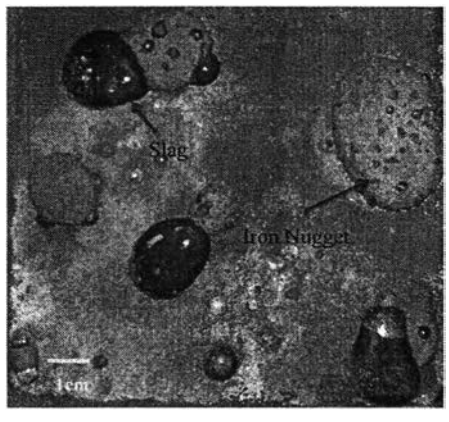
No. 2 1425°C, 20 min
C/Fe = 1.34/1



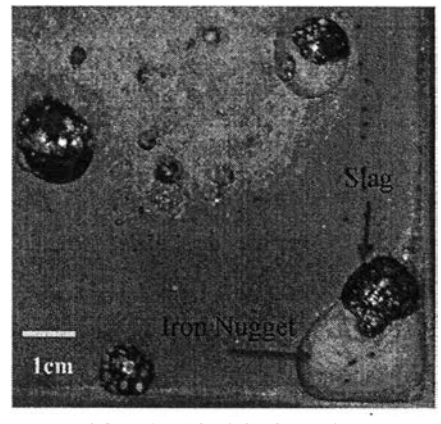
No. 3 1425°C, 20 min
C/Fe = 1.44/1
Iron nugget size = 2.46–6.1 cm
Slag size = 0.74–3.0 cm



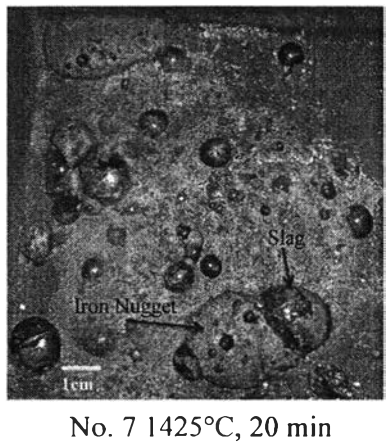
No. 4 1425°C, 20 min
C/Fe = 1.53/1
Iron nugget size = 1.88–3.58 cm
Slag size = 048–2.19 cm



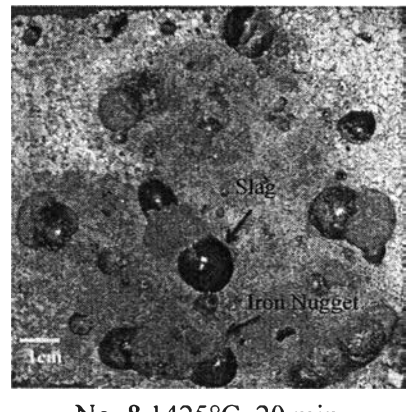
No. 5 1425°C, 20 min
C/Fe = 1.63/1
Iron nugget size = 0.64–3.79 cm
Slag size = 0.47–1.94 cm



No. 6 1425°C, 20 min
C/Fe = 1.72/1
Iron nugget size = 1.22–2.37 cm
Slag size = 0.72–1.36 cm



No. 7 1425°C, 20 min
C/Fe = 1.82/1
Iron nugget size = 0.44–2.39 cm
Slag size = 0.54–1.42 cm



No. 8 1425°C, 20 min
C/Fe = 1.91/1
Iron nugget size = 0.99–2.39 cm
Slag size = 0.69–1.15 cm

Figure D-9 Experiment 5: pellets after the reduction.

Products from the reduction were characterized % wt Element by EDX; characterization is shown in Appendix A-2. Table D-13 shows the % Element of No. 1–8 in the experiment 5. The % yield of No. 1–8 is shown in Table D-14.

Table D-13 Experiment 5 % wt Element of No. 1–8

Element	% wt Element of No. 1-8													
	1	2	3		4		5		6		7		8	
			Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag
C	1.61	1.32	2.06	2.31	2.10	0.90	2.08	5.54	2.77	1.36	2.25	2.36	1.58	0.00
O	10.71	9.06	1.88	31.46	1.18	29.62	1.77	31.17	0.60	33.54	0.76	29.99	0.62	32.72
Al	2.22	2.68	0.37	6.44	0.21	6.91	0.29	6.69	0.21	7.19	0.16	7.05	0.16	7.57
Si	4.71	5.64	0.79	15.03	0.53	16.10	0.68	15.47	0.40	16.87	0.51	16.36	0.39	17.45
K	0.37	0.40	0.00	1.36	0.00	1.11	0.00	1.25	0.00	1.44	0.00	1.11	0.00	0.88
Fe	71.05	69.41	91.08	6.03	93.67	1.90	92.97	3.47	93.95	7.04	94.39	1.83	93.45	1.19
Zr	0.52	0.59	0.11	0.72	0.00	0.33	0.00	0.97	0.00	0.38	0.00	0.30	0.00	0.00
Mn	0.04	0.00	0.00	0.20	0.00	0.00	0.00	0.37	0.00	0.31	0.00	0.13	0.00	0.05
Ca	7.31	9.58	0.52	35.00	0.14	41.65	0.29	33.80	0.23	30.57	0.19	38.71	0.10	38.45
Ti	0.03	0.00	0.00	0.54	0.00	0.64	0.00	0.52	0.00	0.53	0.00	0.61	0.00	0.61
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.09	0.16	0.17	0.00	0.32	0.00	0.20	0.00	0.18	0.00	0.14	0.00	0.36	0.00
P	0.33	0.33	0.82	0.18	0.98	0.00	0.94	0.00	0.93	0.00	0.98	0.00	1.97	0.00
S	0.74	0.49	1.29	0.32	0.83	0.35	0.78	0.21	0.72	0.12	0.62	1.05	1.31	0.49
Mg	0.15	0.22	0.02	0.36	0.03	0.44	0.01	0.41	0.00	0.44	0.00	0.44	0.06	0.46
Na	0.10	0.11	0.00	0.05	0.02	0.05	0.00	0.20	0.00	0.21	0.00	0.06	0.00	0.14
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Element	SD													
	1	2	3		4		5		6		7		8	
			Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag
C	2.44	2.29	0.08	2.31	0.16	1.55	0.47	2.47	0.15	2.36	0.12	4.09	0.26	0.00
O	1.96	2.21	1.21	2.77	1.04	2.02	0.79	2.15	0.13	8.14	0.90	3.43	0.80	2.57
Al	0.05	0.71	0.10	0.63	0.19	0.68	0.08	0.64	0.07	0.73	0.21	0.83	0.07	0.30
Si	0.17	1.44	0.19	1.88	0.41	1.82	0.17	2.08	0.10	1.32	0.34	2.24	0.16	0.69
K	0.05	0.11	0.00	0.09	0.00	0.18	0.00	0.10	0.00	0.22	0.00	0.07	0.00	0.07
Fe	2.38	6.71	1.09	4.51	1.43	1.09	1.10	0.86	0.30	1.58	1.91	0.56	0.79	0.16
Zr	0.57	0.52	0.19	0.30	0.00	0.57	0.00	0.58	0.00	0.66	0.00	0.52	0.00	0.00
Mn	0.07	0.00	0.00	0.19	0.00	0.00	0.00	0.29	0.00	0.11	0.00	0.11	0.00	0.08
Ca	2.33	2.81	0.19	5.60	0.15	2.66	0.14	0.81	0.02	5.46	0.29	2.62	0.09	2.99
Ti	0.05	0.00	0.00	0.09	0.00	0.11	0.00	0.03	0.00	0.07	0.00	0.08	0.00	0.05
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.09	0.19	0.07	0.00	0.21	0.00	0.17	0.00	0.05	0.00	0.16	0.00	0.24	0.00
P	0.34	0.19	0.36	0.31	0.24	0.00	0.21	0.00	0.02	0.00	0.09	0.00	0.20	0.00
S	0.24	0.20	0.31	0.10	0.10	0.11	0.19	0.12	0.03	0.11	0.12	0.64	0.19	0.03
Mg	0.01	0.09	0.03	0.11	0.05	0.03	0.02	0.10	0.00	0.06	0.00	0.05	0.11	0.06
Na	0.18	0.12	0.00	0.04	0.04	0.09	0.00	0.04	0.00	0.16	0.00	0.05	0.00	0.14
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D-14 Experiment 5 % yield after reduction from Iron nuggets

No.	%wt Iron Ore in mixture	%wt Fe in mixture	Dried Weight of 3 pellets (g)	Fe In put (g)	% Fe Nugget from EDX	Iron nugget (g)	Fe Output (g)	% Yield	Separation status
1	67.22	37.64	155.24	58.43	-	-	-	-	Direct reduction
2	65.94	36.93	156.19	57.68	-	-	-	-	Direct reduction
3	64.71	36.24	159.23	57.71	91.08	61.92	56.40	97.73	Complete
4	63.53	35.58	149.90	53.33	93.67	57.60	53.95	101.17	Complete
5	62.39	34.94	150.10	52.44	92.97	54.72	50.88	97.01	Complete
6	61.29	34.32	153.05	52.53	93.95	52.51	49.34	93.92	Complete
7	60.23	33.73	152.96	51.59	94.39	49.20	46.44	90.02	Complete
8	59.20	33.15	156.35	51.83	93.45	52.69	49.24	95.00	Complete

The mol ratio C/Fe = 1.53 of No. 4 is suitable because high % Fe in Iron nuggets, high % Yield, and low Dai coal usage. The % yield after the reduction of No. 4 is over 100 % because other raw materials have iron contents (Dai coal has % Fe = 2.25 and Bentonite has % Fe = 3.56) and errors from the measurements.

Table D-15 Experiment 5 density of Iron nuggets

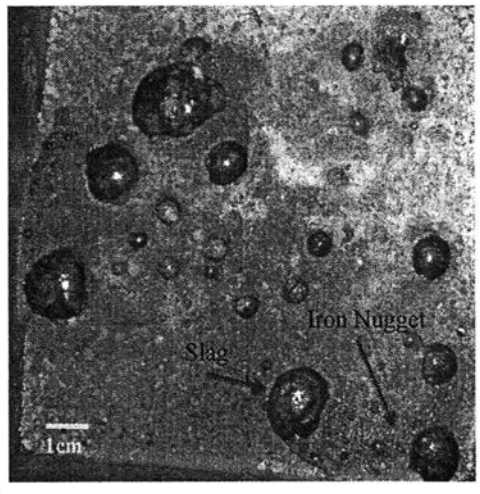
No.	% Fe Nugget from EDX	Density (g/cm^3)	
		Average	SD
1	-	-	-
2	-	-	-
3	91.08	6.1410	0.1512
4	93.67	7.0701	0.2173
5	92.97	6.4010	0.1992
6	93.95	7.1340	0.3241
7	94.39	7.3518	0.2151
8	93.45	6.9439	0.3119

D.6 Experiment 6

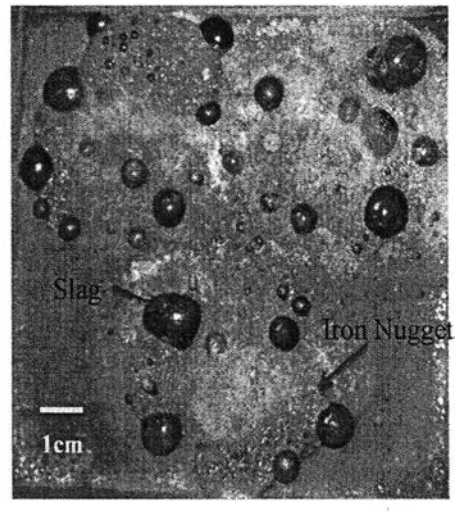
Experiment 6 using the mol ratio of mixture C/Fe = 1.53 (the suitable mol ratio from Experiment 5.) and the mol ratio Limestone/Al_2O_3+SiO_2 of mixture was varied to minimize the Limestone usage. All pellets were reduced at the reduction temperature 1425°C and the reduction time of 20 min. The weights of No. 1–9 after the reduction are shown in table D-16.

Table D-16 Experiment 5; the weight of No. 1–9 after the reduction through Mold A

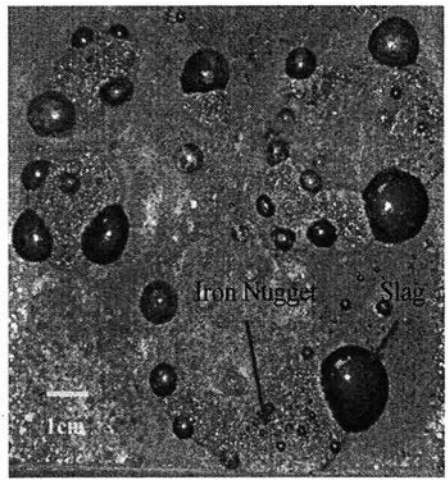
No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	Mol ratio Limestone/Al_2O_3+SiO_2	After Reduction (3 pellets) (g)	
				Iron nugget	Slag
1	1425	20	0.50	63.07	13.76
2			0.60	60.82	18.06
3			0.70	63.56	18.07
4			0.75	59.92	17.52
5			0.89	63.88	23.78
6			1.00	61.71	23.16
7			1.26	60.25	19.45
8			1.76	83.19	
9			2.26	69.30	



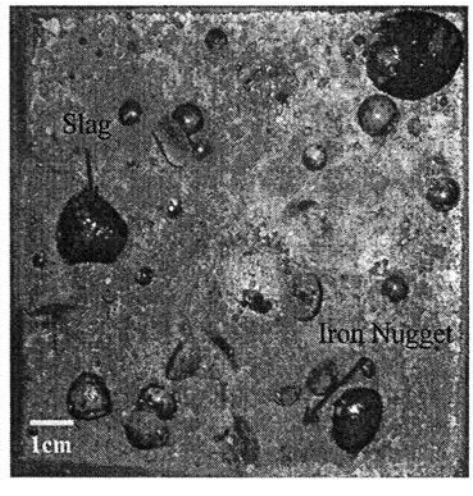
No. 1 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 0.5/1
Iron nugget size = 0.25–3.89 cm
Slag size = 0.67–1.66 cm



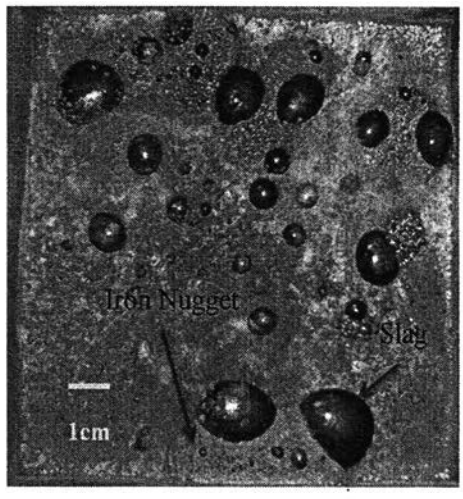
No. 2 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 0.6/1
Iron nugget size = 0.96–3.53 cm
Slag size = 0.13–1.46 cm



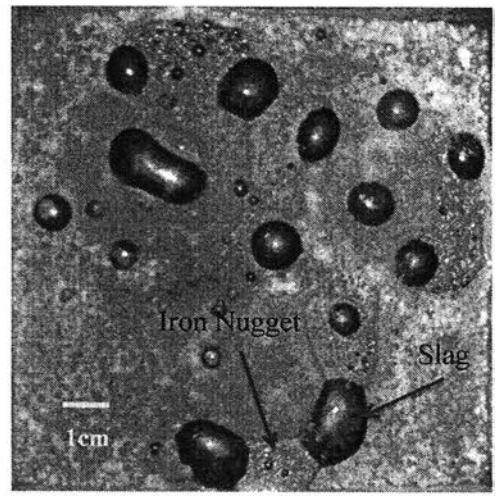
No. 3 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 0.7/1
Iron nugget size = 0.86–1.33 cm
Slag size = 0.27–1.45 cm



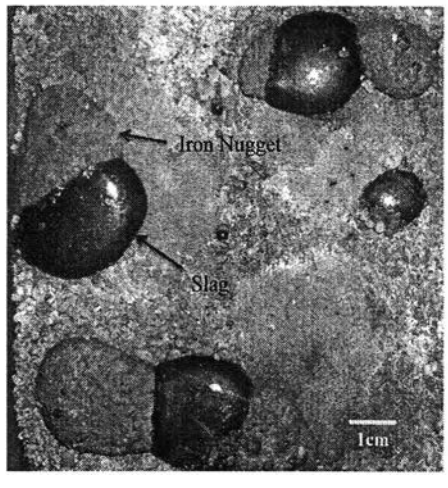
No. 4 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 0.75/1
Iron nugget size = 0.49–3.19 cm
Slag size = 0.3–2.25 cm



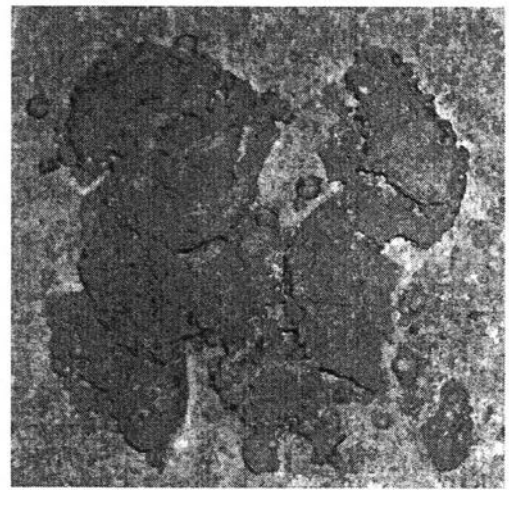
No. 5 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 0.89/1
Iron nugget size = 0.35–2.94 cm
Slag size = 0.35–1.65 cm



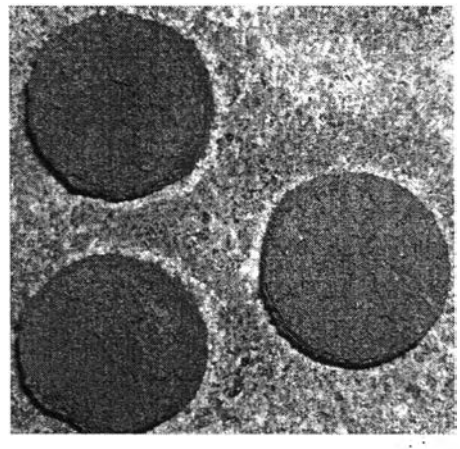
No. 6 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 1.0/1
Iron nugget size = 0.99–2.23 cm
Slag size = 0.78–1.99 cm



No. 6 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 1.26/1
Iron nugget size = 0.59–2.41 cm
Slag size = 1.83–2.75 cm



No. 7 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 1.76/1



No. 8 1425°C, 20 min
Limestone/Al_2O_3+SiO_2= 2.26/1

Figure D-10 Experiment 6: the pellets after the reduction.

Products from the reduction were characterized % wt Element by EDX; characterization result is shown in Appendix A-2. Table D-17 shows the % Element of No. 1-9 in the experiment 6. The % yield of No. 1–9 is shown in Table D-18.

Table D-17 Experiment 6 % wt Element of No. 1–9

Element	% wt Element of pellet															
	1		2		3		4		5		6		7		8	9
	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag		
C	8.68	0.28	26.26	4.14	15.56	0.70	2.66	0.00	7.17	3.72	15.30	1.29	7.53	0.64	8.11	14.71
O	0.34	40.97	0.39	44.65	1.15	41.33	0.28	35.06	0.88	38.34	1.28	43.68	0.82	32.68	13.12	12.85
Al	0.18	9.75	0.44	8.62	0.22	8.28	0.08	7.93	0.11	7.03	0.09	7.40	0.13	6.03	5.28	1.45
Si	0.26	20.02	0.14	18.51	0.18	18.49	0.26	18.27	0.33	15.86	0.26	16.45	0.37	14.42	2.68	2.76
K	0.00	1.50	0.00	1.26	0.00	1.43	0.00	1.34	0.00	0.87	0.00	0.67	0.00	0.65	0.25	0.06
Fe	89.24	3.47	71.37	1.39	81.00	1.94	94.80	1.76	89.39	1.69	80.63	0.50	89.61	2.64	53.83	49.04
Zr	0.00	0.14	0.14	0.00	0.10	0.19	0.00	0.00	0.10	0.11	0.00	0.15	0.26	0.13	0.70	0.56
Mn	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.23	0.14	0.00
Ca	0.05	22.08	0.00	20.51	0.05	27.16	0.12	33.66	0.06	31.33	0.37	28.58	0.05	41.05	14.08	15.96
Ti	0.00	0.54	0.00	0.17	0.00	0.14	0.00	0.59	0.00	0.30	0.00	0.17	0.00	0.50	0.10	0.22
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.15	0.00	0.05	0.00	0.11	0.00	0.14	0.00	0.15	0.00	0.00	0.00	0.25	0.00	0.07	0.02
P	0.56	0.00	0.71	0.00	0.94	0.00	0.86	0.00	1.04	0.00	1.05	0.00	0.54	0.00	0.37	0.32
S	0.51	0.19	0.51	0.04	0.70	0.00	0.78	0.49	0.75	0.33	1.01	0.60	0.43	0.58	1.25	1.95
Mg	0.00	0.56	0.00	0.49	0.00	0.34	0.00	0.50	0.01	0.41	0.00	0.50	0.00	0.45	0.03	0.09
Na	0.03	0.35	0.00	0.22	0.00	0.00	0.00	0.25	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Element	SD															
	1		2		3		4		5		6		7		8	9
	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag		
C	0.41	0.49	2.34	3.72	1.51	1.21	0.70	0.00	1.20	4.18	1.55	1.78	0.49	1.10	3.03	3.06
O	0.35	0.80	0.68	3.49	1.08	2.55	0.25	3.38	1.10	8.87	1.15	2.67	0.27	2.62	2.00	1.58
Al	0.18	0.92	0.23	0.53	0.39	0.36	0.08	0.41	0.02	0.71	0.07	0.19	0.02	0.21	3.33	0.23
Si	0.22	0.53	0.10	1.48	0.07	0.52	0.13	0.52	0.08	1.67	0.22	0.24	0.07	0.61	0.19	0.34
K	0.00	0.04	0.00	0.28	0.00	0.21	0.00	0.26	0.00	0.27	0.00	0.03	0.00	0.13	0.23	0.05
Fe	1.42	0.10	2.25	0.51	2.41	0.52	0.57	0.76	1.00	0.96	1.20	0.16	0.56	0.94	0.45	6.25
Zr	0.00	0.24	0.17	0.00	0.17	0.33	0.00	0.00	0.09	0.19	0.00	0.27	0.11	0.23	0.31	0.21
Mn	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.27	0.14	0.00
Ca	0.04	1.44	0.00	4.91	0.04	2.76	0.21	3.40	0.06	7.65	0.51	4.08	0.04	3.44	1.61	3.33
Ti	0.00	0.05	0.00	0.17	0.00	0.13	0.00	0.07	0.00	0.15	0.00	0.02	0.00	0.03	0.10	0.09
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.13	0.00	0.08	0.00	0.10	0.00	0.13	0.00	0.12	0.00	0.00	0.00	0.09	0.00	0.09	0.04
P	0.12	0.00	0.10	0.00	0.18	0.00	0.21	0.00	0.15	0.00	0.07	0.00	0.20	0.00	0.53	0.08
S	0.03	0.12	0.06	0.06	0.08	0.00	0.18	0.08	0.09	0.12	0.54	0.09	0.13	0.23	0.59	0.84
Mg	0.00	0.04	0.00	0.11	0.00	0.21	0.00	0.05	0.02	0.17	0.00	0.11	0.00	0.03	0.03	0.10
Na	0.05	0.07	0.00	0.21	0.00	0.00	0.00	0.05	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D-18 Experiment 6 % yield after reduction from Iron nuggets

No	%wt Iron Ore in mixture	%wt Fe in mixture	Dried Weight of 3 pellets (g)	Fe In put (g)	% Fe Nugget from EDX	Iron nugget (g)	Fe Output (g)	% Yield	Separation status
1	65.33	36.58	156.31	57.18	89.24	63.07	56.28	98.42	Complete
2	64.86	36.32	157.64	57.26	71.37	60.82	43.41	75.80	Complete
3	64.40	36.06	157.90	56.94	81.00	63.56	51.49	90.41	Complete
4	64.15	35.93	158.27	56.86	94.80	59.92	56.81	99.90	Complete
5	63.53	35.58	163.91	58.31	89.39	63.88	57.10	97.92	Complete
6	63.04	35.30	159.70	56.38	80.63	61.71	49.76	88.26	Complete
7	61.93	34.68	159.31	55.25	89.61	60.25	53.99	97.73	Complete
8	59.85	33.52	160.60	-	-	-	-	-	Direct reduction
9	57.91	32.43	157.36	-	-	-	-	-	Direct reduction

At the reduction temperature 1425°C and the reduction time of 20 min and the mol ratio of mixture C/Fe = 1.53. The mol ratio Limestone/Al_2O_3+SiO_2 = 0.75 of No. 4 is suitable because high % Fe in Iron nuggets, high % Yield, and the low Limestone usage. The microstructure of Iron nugget No. 4 is shown in Figure D-11.

Table D-19 Experiment 6 density of Iron nuggets

No.	% Fe Nugget from EDX	Density (g/cm^3)	
		Average	SD
1	89.24	6.1017	0.4219
2	71.37	5.6549	0.1861
3	81.00	6.4182	0.4096
4	94.80	7.1195	0.3753
5	89.39	7.1106	0.2779
6	80.63	6.3356	0.3188
7	89.61	6.7752	0.3230
8	-	-	-
9	-	-	-

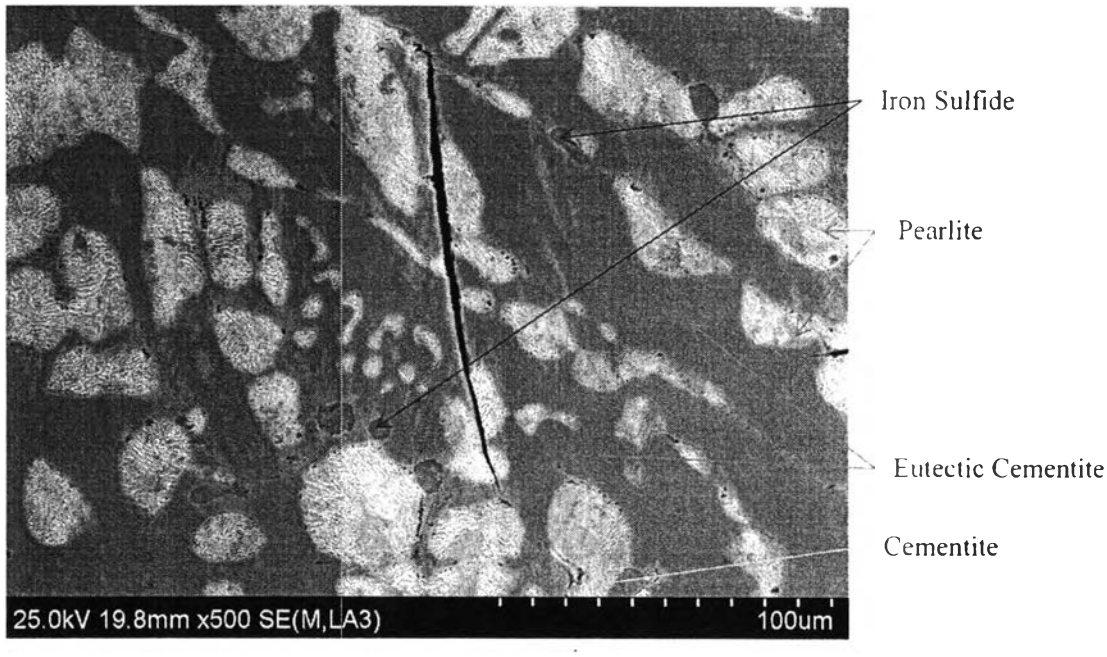


Figure D-11 The backscattered SEM image of cross section iron nugget from Experiment 6, No. 3 at reduction temperature 1,425°C and reduction time of 20 min.

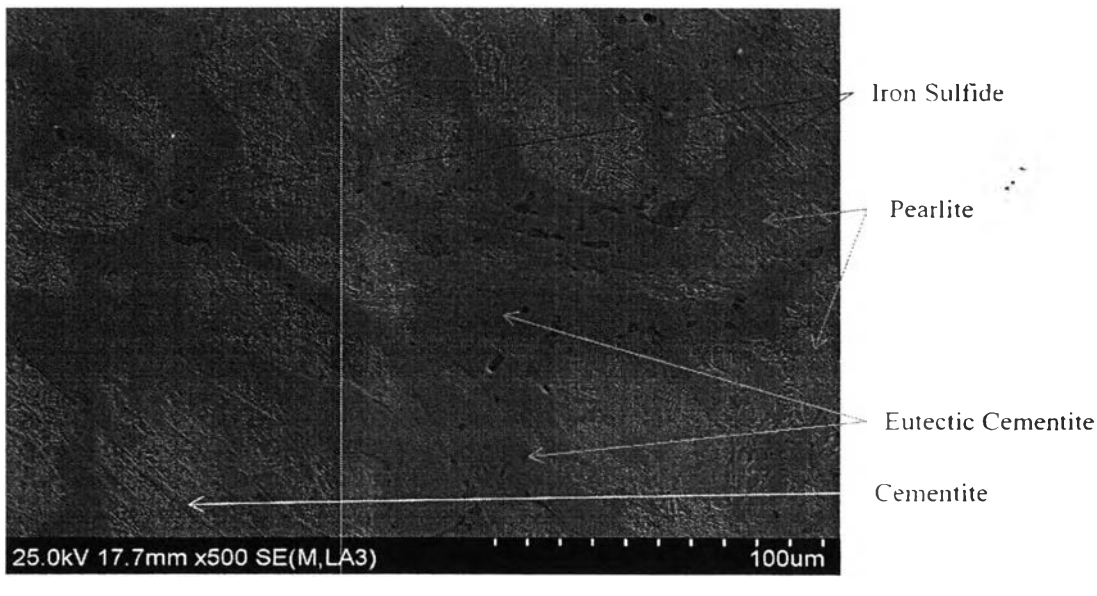


Figure D-12 The backscattered SEM image of cross section iron nugget from Experiment 6, No. 4 at reduction temperature 1,425°C and reduction time of 20 min.

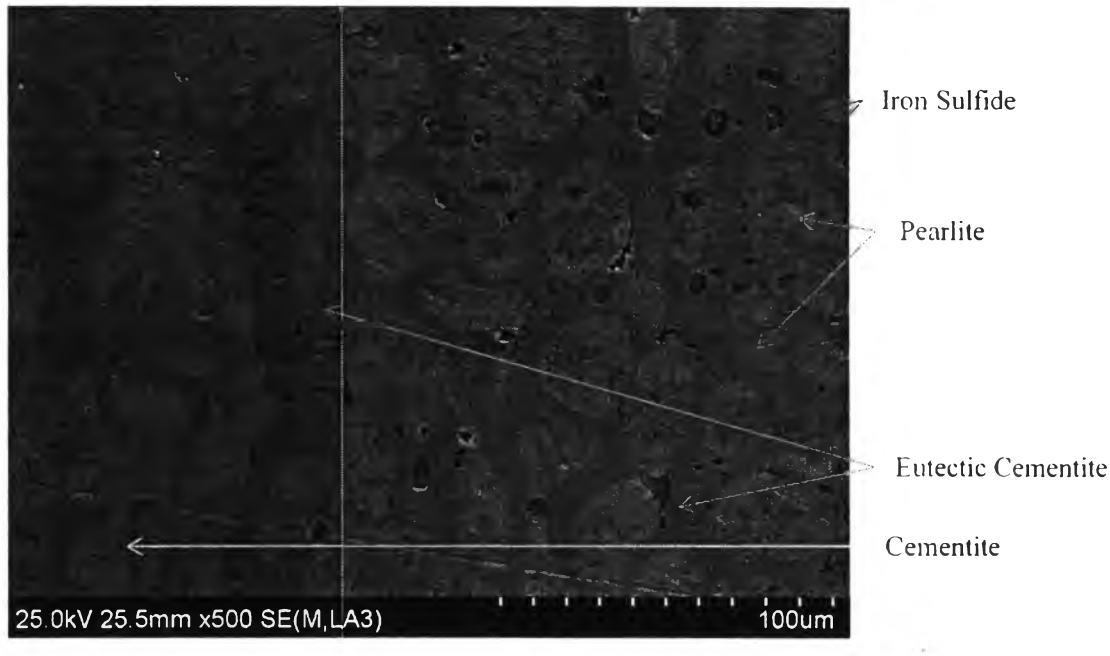


Figure D-13 The backscattered SEM image of cross section iron nugget from Experiment 6, No. 5 at reduction temperature 1,425°C and reduction time of 20 min.

The lamellar structure represents pearlite, which is alternating layers of α iron and Fe3C, light-gray areas represent cementite (Fe3C) and dark-gray areas represent the iron sulfides. This structure is similar to the white cast iron.

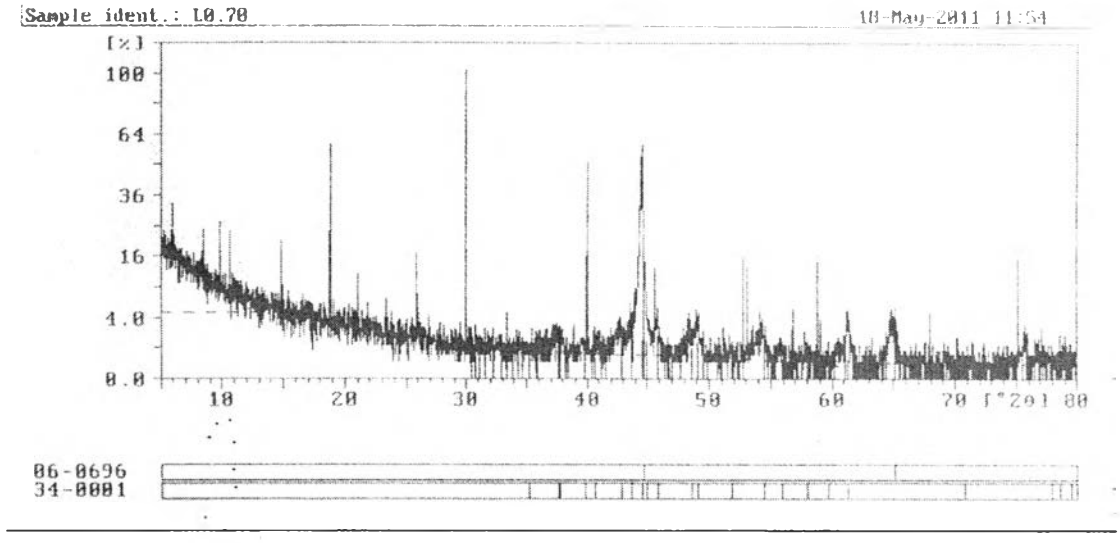


Figure D-14 XRD spectrum of Iron nugget, Experiment 6, No. 3 (34-0001: Cementite and 06-0696: Iron).

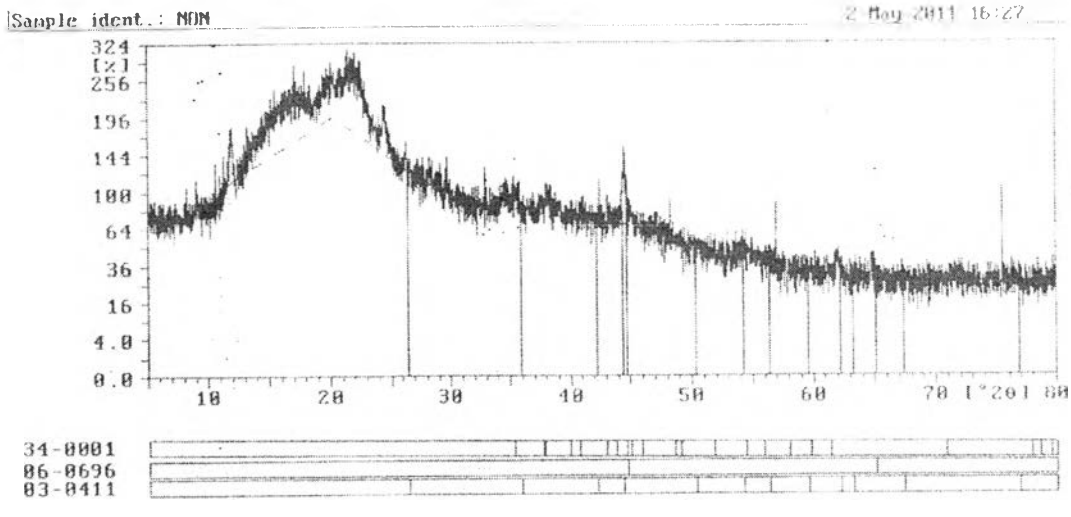


Figure D-15 XRD spectrum of Iron nugget, Experiment 6, No. 4 (34-0001: Cementite, 06-0696: Iron and 03-0411: Iron carbide).

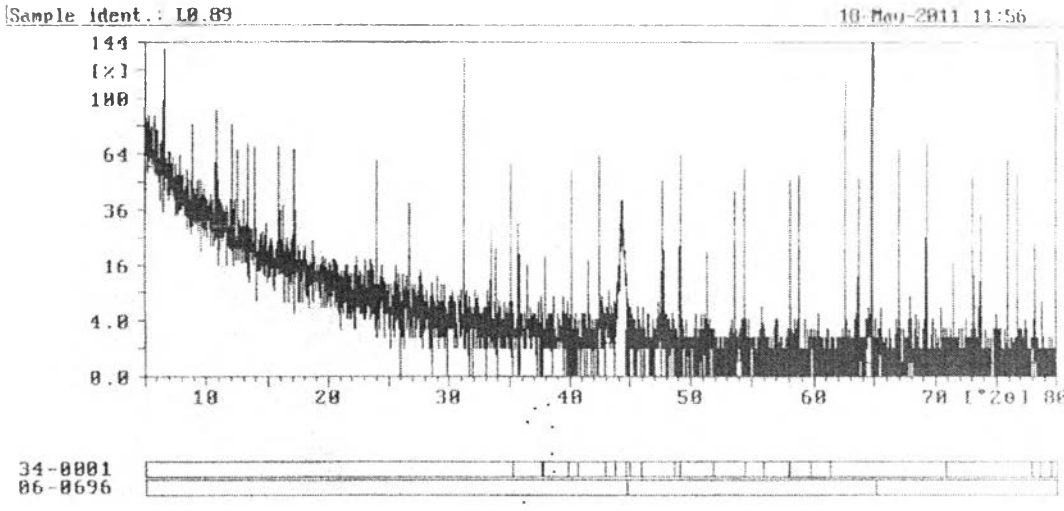


Figure D-16 XRD spectrum of Iron nugget, Experiment 6, No. 5 (34-0001: Cementite and 06-0696: Iron).

Appendix E: Raw Data

E.1 Scanning electron microscope (SEM)

The particle size was measured by SEM (Hitachi, model S-4800), a scanning electron microscope. The SEM accelerating voltage, current and magnification are specified in the figures below.

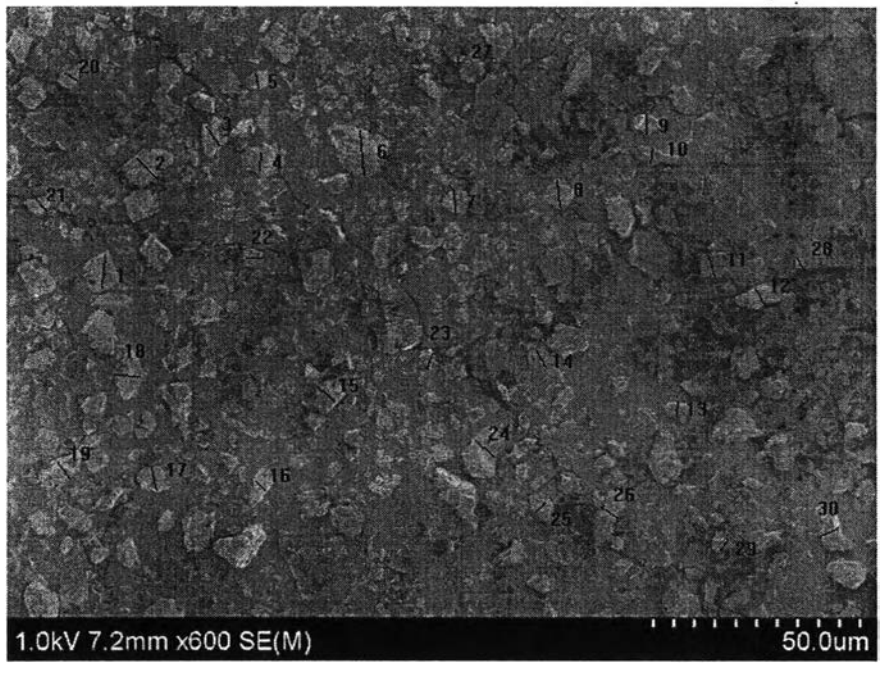


Figure E-1 Particle of Limestone from SEM.

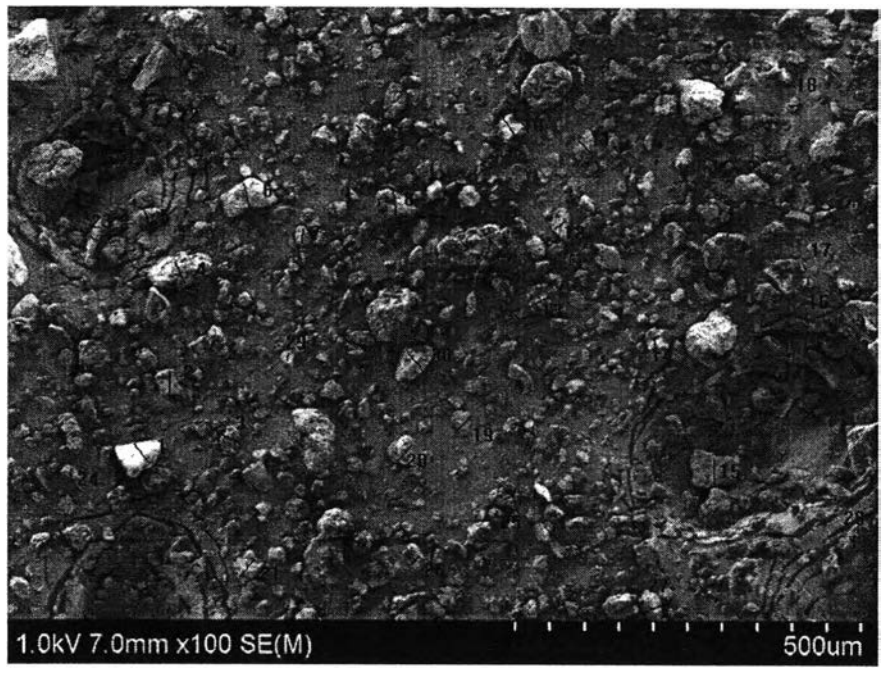


Figure E-2 Particle of Bentonite from SEM.

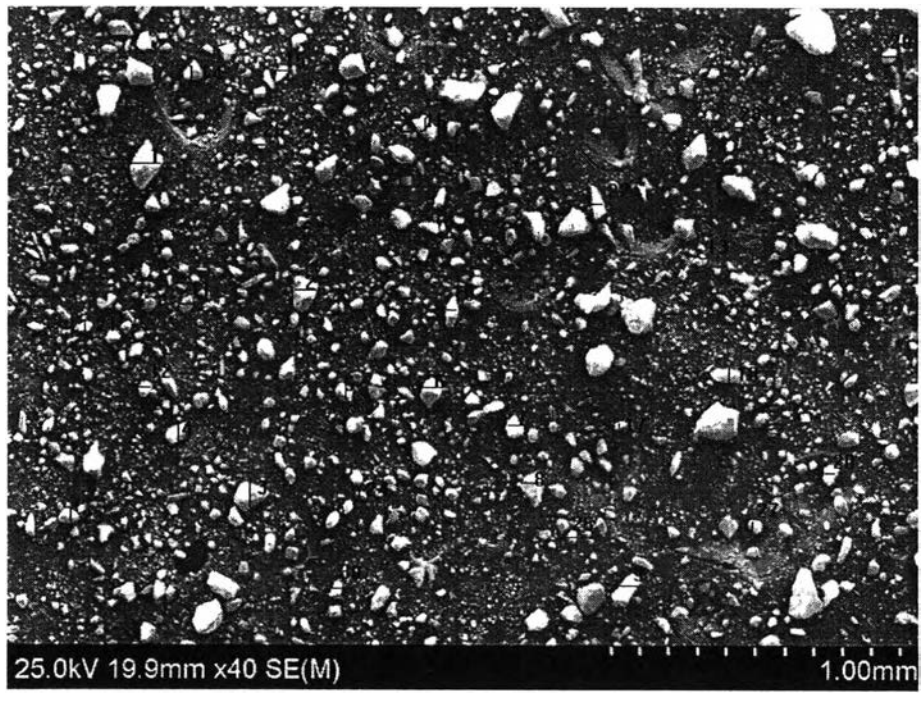


Figure E-3 Particle of XK-01 after grinding from SEM.

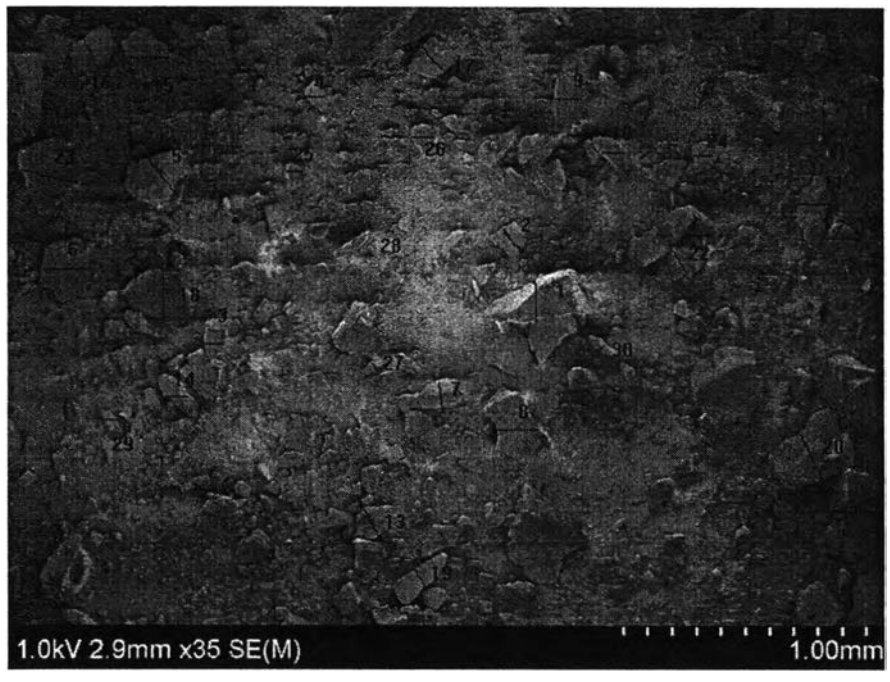


Figure E-4 Particle of Dai coal after grinding from SEM.

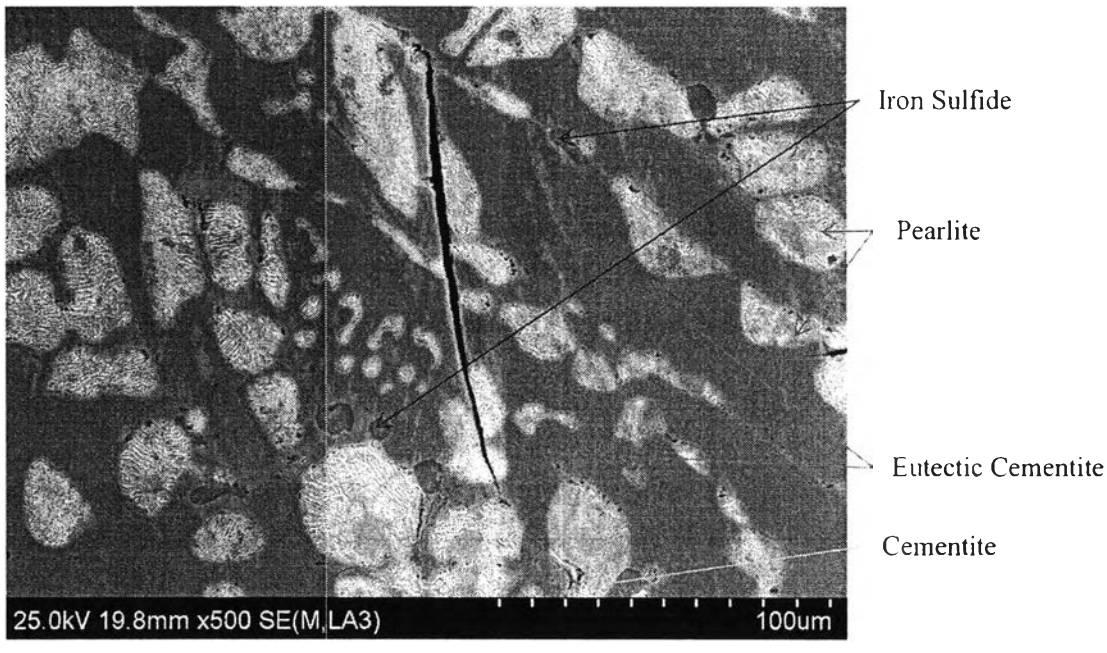


Figure E-5 The backscattered SEM image of cross section iron nugget from Experiment 6, No. 3 at reduction temperature 1,425°C and reduction time of 20 min.

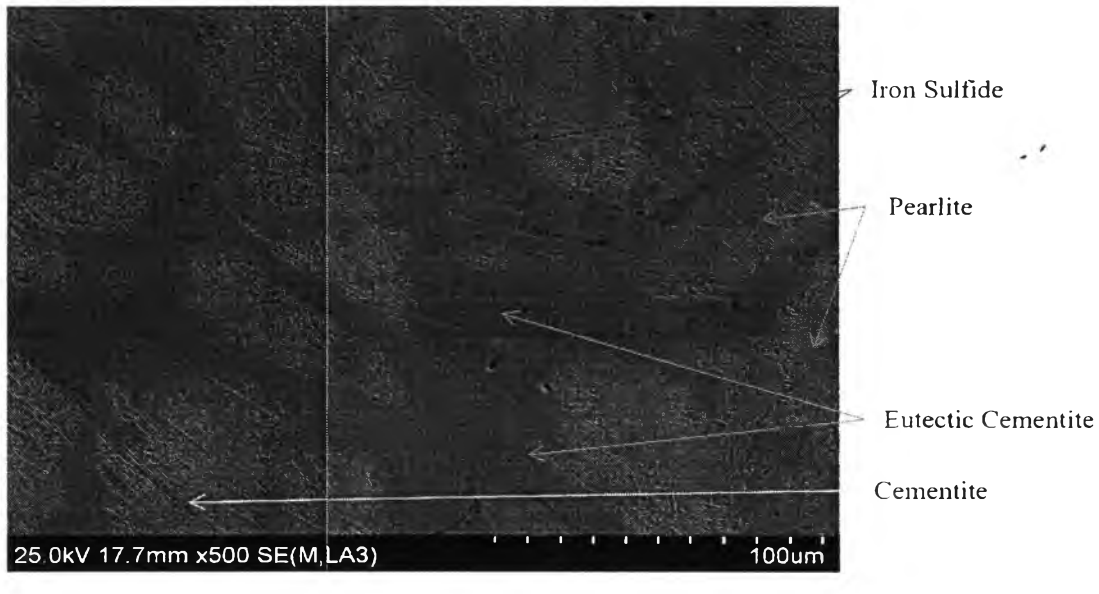


Figure E-6 The backscattered SEM image of cross section iron nugget from Experiment 6, No. 4 at reduction temperature 1,425°C and reduction time of 20 min.

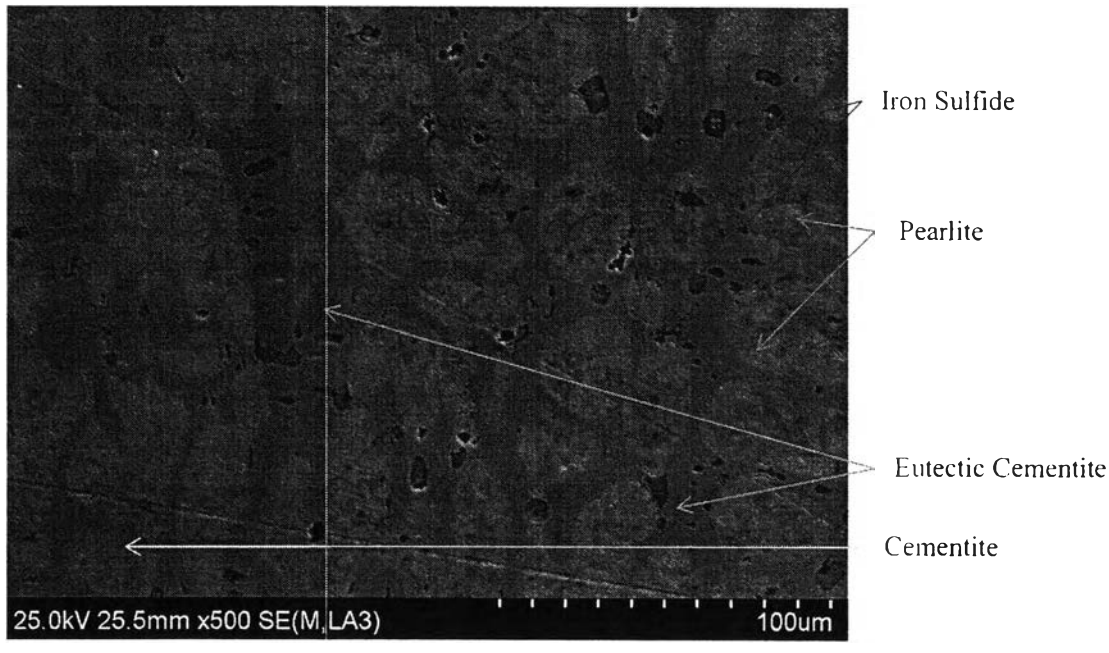


Figure E-7 The backscattered SEM image of cross section iron nugget from Experiment 6, No. 5 at reduction temperature 1,425°C and reduction time of 20 min.

Energy Dispersive X-Ray Fluorescence Spectrometer (EDXRF)

The samples were ground into fine and characterized for % wt of Element by EDX (Horiba, model 51-ADD0014), an Energy Dispersive X-Ray Fluorescence Spectrometer (Hitachi, model S-4800), connected to a scanning electron microscope. The SEM accelerating voltage and current were 25 kV and 20 μA, respectively. The magnification was 100X. The pellets were stacked onto stubs by using sticker carbon papers. The specimens were coated with platinum using an ion coating machine (Hitachi, model E-1010) for 90 sec, for enhancing the electron conductivity. The specimens were clamped on the holder and placed into a high vacuum SEM chamber for preventing the attenuation of X-ray by the air molecules.

E.1.1 XK-01

Table E-1 % wt of Element and % Atomic of XK-01 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	4.31	2.18	5.67	4.17	0.00	8.68	4.32	11.97	7.90
O	46.73	36.92	38.47	32.63	6.03	73.46	60.84	64.58	55.00	5.29
Al	2.53	2.24	2.30	1.74	0.55	2.36	2.21	2.31	1.74	0.43
Si	3.38	3.31	2.71	2.57	0.64	3.02	3.16	2.61	2.51	0.61
K	0.36	0.32	0.37	0.26	0.12	0.23	0.21	0.25	0.18	0.06
Fe	45.66	51.71	52.80	56.00	10.09	20.56	24.51	25.58	28.19	9.33
Zr	1.35	1.10	1.18	0.92	0.42	0.37	0.31	0.35	0.27	0.09
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.04	0.00	0.03	0.03	0.00	0.02	0.00	0.02	0.02
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.05	0.08	0.00	0.00	0.00	0.02	0.04
P	0.00	0.06	0.00	0.12	0.16	0.00	0.05	0.00	0.11	0.16
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-2 % wt of Element and % Atomic of XK-01 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	10.35	14.26	7.18	10.60	3.55	20.98	28.80	14.47	21.42	7.17
O	35.24	29.87	36.03	33.71	3.35	53.62	45.29	57.46	52.12	6.22
Al	1.83	1.42	1.98	1.74	0.29	1.65	1.28	1.89	1.61	0.31
Si	2.25	1.65	2.52	2.14	0.45	1.95	1.43	2.32	1.90	0.45
K	0.33	0.38	0.25	0.32	0.06	0.21	0.24	0.15	0.20	0.04
Fe	48.77	51.86	50.54	50.39	1.55	21.26	22.53	23.22	22.34	1.00
Zr	1.23	0.00	1.40	0.88	0.76	0.33	0.00	0.39	0.24	0.21
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.56	0.11	0.22	0.30	0.00	0.44	0.08	0.17	0.24
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-3 % wt of Element and % Atomic of XK-01 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.36	2.36	0.00	1.57	1.36	6.24	6.08	0.00	4.10	3.55
O	25.74	28.24	41.31	31.77	8.36	50.54	53.92	69.45	57.97	10.09
Al	1.15	1.21	2.37	1.58	0.69	1.36	1.38	2.36	1.70	0.57
Si	2.15	1.53	2.67	2.12	0.57	2.41	1.68	2.56	2.21	0.47
K	0.12	0.14	0.34	0.20	0.12	0.10	0.11	0.23	0.15	0.07
Fe	67.52	65.44	51.79	61.58	8.55	38.80	36.22	24.95	33.32	7.36
Zr	0.44	0.50	1.52	0.82	0.61	0.16	0.18	0.45	0.26	0.16
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.06	0.09	0.00	0.05	0.05	0.04	0.06	0.00	0.03	0.03
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.14	0.15	0.00	0.10	0.08	0.07	0.07	0.00	0.05	0.04
P	0.30	0.33	0.00	0.21	0.18	0.30	0.32	0.00	0.21	0.18
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

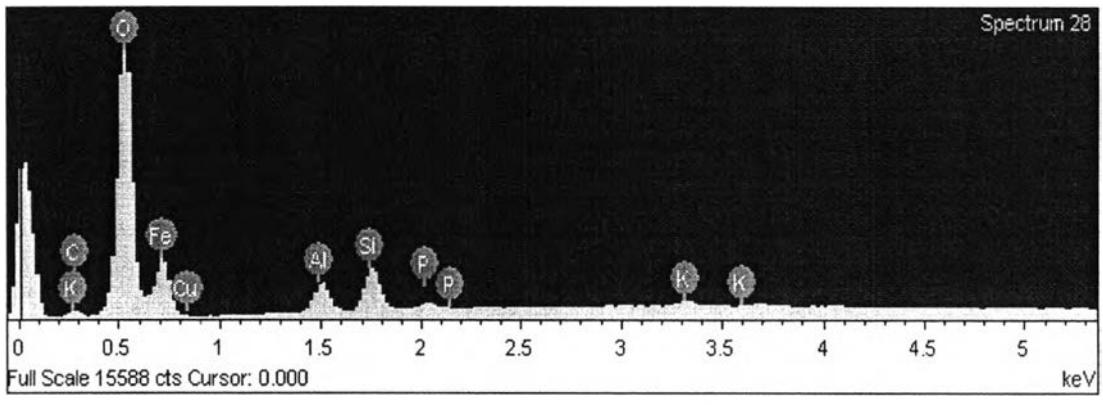


Figure E-8 EDX spectrum of XK-01 1st specimen.

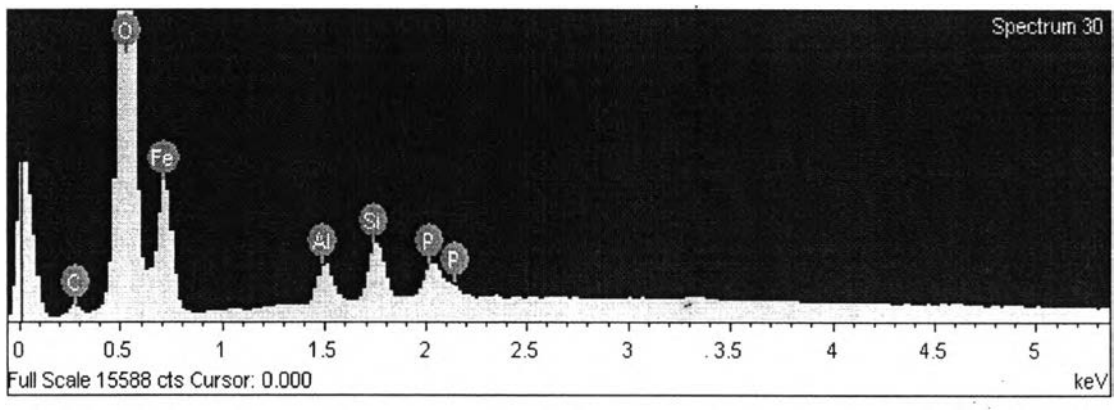


Figure E-9 EDX spectrum of XK-01 2nd specimen.

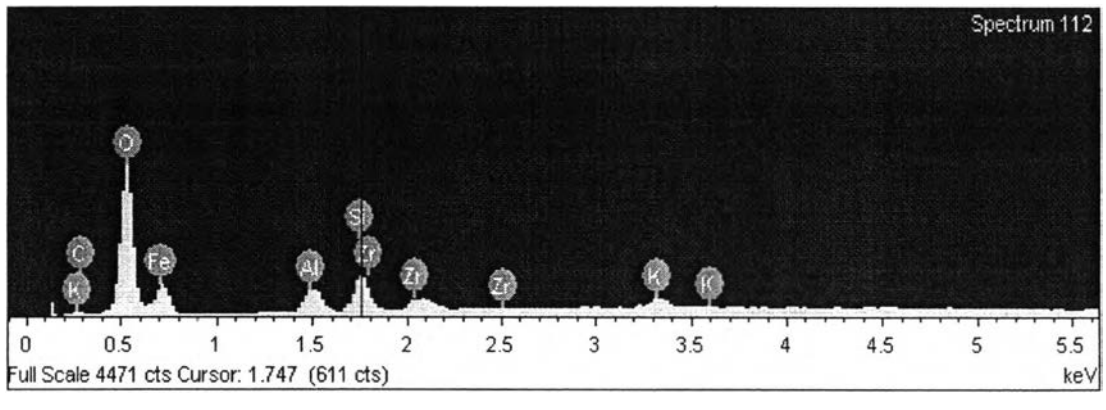


Figure E-10 EDX spectrum of XK-01 3rd specimen.

E.1.2 Experiment 1

Table E-4 Experiment 1 % wt of Element and % Atomic of No. 1 (1500°C, 50 min) 1st specimen

Element	% Element				% Atomic			
	1	2	average	SD	1	2	average	SD
C	0.00	0.00	0.00	-	0.00	0.00	0.00	-
O	26.14	30.37	28.26	2.99	50.9	57.35	54.13	4.56
Al	5.1	3.13	4.12	1.39	5.89	3.5	4.70	1.69
Si	4.54	3.13	3.84	1.00	5.04	3.37	4.21	1.18
K	0.2	0.00	0.10	0.14	0.16	0.00	0.08	0.11
Fe	55.31	57.57	56.44	1.60	30.86	31.15	31.01	0.21
Zr	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Ca	6.97	4.61	5.79	1.67	5.42	3.47	4.45	1.38
Ti	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	-	0.00	0.00	0.00	-
P	1.46	0.84	1.15	0.44	1.47	0.82	1.15	0.46
S	0.28	0.35	0.32	0.05	0.27	0.33	0.30	0.04
Mg	0.00	0.00	0.00	-	0	0	0.00	-
Na	0.00	0.00	0.00	-	0	0	0.00	-
Cl	0.00	0.00	0.00	-	0	0	0.00	-
Total	100	100	100.00	-	100	100	100.00	-

Table E-5 Experiment 1 % wt of Element and % Atomic of No. 1 (1500°C, 50 min) 2nd specimen

Element	% Element				% Atomic			
	1	2	average	SD	1	2	average	SD
C	0.00	0.00	0.00	-	0.00	0.00	0.00	-
O	35.39	25.37	30.38	7.09	63.69	50.09	56.89	9.62
Al	2.91	5.55	4.23	1.87	3.11	6.5	4.81	2.40
Si	2.03	3.96	3.00	1.36	2.08	4.46	3.27	1.68
K	0.00	0.18	0.09	0.13	0.00	0.14	0.07	0.10
Fe	49.01	57.3	53.16	5.86	25.27	32.42	28.85	5.06
Zr	4.84	0.00	2.42	3.42	1.53	0.00	0.77	1.08
Mn	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Ca	5.04	6.02	5.53	0.69	3.62	4.74	4.18	0.79
Ti	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	-	0.00	0.00	0.00	-
P	0	1.24	0.62	0.88	0	1.26	0.63	0.89
S	0.78	0.39	0.59	0.28	0.7	0.39	0.55	0.22
Mg	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	-	0	0	0.00	-
Total	100	100	100.00	-	100	100	100.00	-

Table E-6 Experiment 1 % wt of Element and % Atomic of No. 1 (1500°C, 50 min) 3rd specimen

Element	% Element				% Atomic			
	1	2	average	SD	1	2	average	SD
C	25.66	0.00	12.83	18.14	46.49	0.00	23.25	32.87
O	23.45	24.54	24.00	0.77	31.89	48.41	40.15	11.68
Al	2.94	8.47	5.71	3.91	2.37	9.91	6.14	5.33
Si	1.16	4.11	2.64	2.09	0.9	4.62	2.76	2.63
K	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Fe	44.61	56.88	50.75	8.68	17.38	32.15	24.77	10.44
Zr	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Ca	1.11	5.19	3.15	2.88	0.6	4.08	2.34	2.46
Ti	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Cu	1.07	0.00	0.54	0.76	0.37	0.00	0.19	0.26
P	0.00	0.81	0.41	0.57	0.00	0.83	0.42	0.59
S	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Mg	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	-	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	-	0	0	0.00	-
Total	100	100	100.00	-	100	100	100.00	-

Table E-7 Experiment 1 % wt of Element and % Atomic of No. 2 (1400°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
O	31.79	32.04	22.89	28.26	28.75	4.27	56.85	56.53	46.27	53.63	53.32	4.92
Al	5.36	6.32	5.6	4.68	5.49	0.68	5.68	6.61	6.72	5.27	6.07	0.71
Si	5.78	6.7	5.28	4.62	5.60	0.88	5.88	6.73	6.08	4.99	5.92	0.72
K	0.31	0.45	0.4	0.00	0.29	0.20	0.22	0.32	0.33	0.00	0.22	0.15
Fe	47.22	44.62	56.45	54	50.57	5.57	24.19	22.55	32.69	29.35	27.20	4.67
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	7.87	8.33	7.96	6.81	7.74	0.65	5.62	5.87	6.42	5.16	5.77	0.53
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.39	1.17	1.42	1.63	1.40	0.19	1.28	1.06	1.48	1.6	1.36	0.24
S	0.29	0.38	0	0	0.17	0.20	0.26	0.33	0	0	0.15	0.17
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-8 Experiment 1 % wt of Element and % Atomic of No. 2 (1400°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	4.37	0.00	0.00	1.09	2.19	0.00	9.9	0.00	0.00	2.48	4.95
O	27.2	30.38	30.96	27.1	28.91	2.05	51.73	51.71	56.31	52.71	53.12	2.18
Al	4.32	5.99	5.31	5.59	5.30	0.71	4.87	6.04	5.73	6.45	5.77	0.67
Si	6.49	3.94	5.58	3.71	4.93	1.33	7.03	3.82	5.78	4.11	5.19	1.50
K	0.35	0.00	0.38	0.00	0.18	0.21	0.27	0.00	0.28	0.00	0.14	0.16
Fe	51.5	48.63	50.24	58.84	52.30	4.51	28.06	23.71	26.18	32.79	27.69	3.84
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	8.62	5.32	6.35	3.67	5.99	2.07	6.54	3.61	4.61	2.85	4.40	1.60
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.18	1.09	1.17	1.09	1.13	0.05	1.16	0.96	1.1	1.09	1.08	0.08
S	0.35	0.29	0.00	0.00	0.16	0.19	0.33	0.25	0.00	0.00	0.15	0.17
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-9 Experiment 1 % wt of Element and % Atomic of No. 2 (1400°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
0.00 C	0	3.67	0.00	0.00	0.92	1.84	0.00	7.96	0.00	0.00	1.99	3.98
O	32.86	35.23	25.73	30.67	31.12	4.05	59.4	57.3	51.75	56.68	56.28	3.24
Al	3.49	3.42	3.92	5.85	4.17	1.14	3.75	3.3	4.68	6.41	4.54	1.38
Si	3.14	3.4	3.03	3.51	3.27	0.22	3.24	3.15	3.47	3.69	3.39	0.24
K	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Fe	51.74	41.63	62.56	54.29	52.56	8.62	26.8	19.39	36.05	28.74	27.75	6.85
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	6.41	8.98	3.79	4.33	5.88	2.36	4.63	5.83	3.04	3.19	4.17	1.32
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	2.35	3.33	0.98	1.35	2.00	1.06	2.19	2.8	1.02	1.29	1.83	0.82
0.00 S	0.00	0.33	0.00	0.00	0.08	0.17	0	0.27	0.00	0.00	0.07	0.14
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-10 Experiment 1 % wt of Element and % Atomic of No. 3 (1300°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	6.64	0.1	0.00	9.24	4.00	4.68	16.82	0.28	0.00	22.31	9.85	11.44
O	22.35	23.39	31.11	21.15	24.50	4.50	42.5	48.11	56.68	38.32	46.40	7.94
Al	1.22	2.41	3.09	1.29	2.00	0.91	1.38	2.93	3.34	1.38	2.26	1.03
Si	1.55	4.96	6.59	2.76	3.97	2.25	1.68	5.81	6.83	2.85	4.29	2.43
K	0.00	0.34	0.33	0.00	0.17	0.19	0.00	0.29	0.24	0.00	0.13	0.15
Fe	66.05	61.34	49.81	60.94	59.54	6.89	35.97	36.15	26	31.63	32.44	4.77
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	2.18	6.17	7.64	3.84	4.96	2.42	1.66	5.06	5.56	2.78	3.77	1.85
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.00	0.99	1.06	0.78	0.71	0.49	0.00	1.05	1	0.73	0.70	0.48
S	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.32	0.34	0.00	0.17	0.19
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-11 Experiment 1 % wt of Element and % Atomic of No. 3 (1300°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
O	19.12	20.75	24.38	17.97	20.56	14.25	42.41	44.88	49.58	40.81	44.42	3.83
Al	2.11	2.21	2.59	2.05	2.24	0.46	2.77	2.84	3.13	2.76	2.88	0.17
Si	4.46	4.16	4.91	4	4.38	0.67	5.63	5.13	5.69	5.18	5.41	0.29
K	0.23	0.24	0.27	0.23	0.24	0.02	0.21	0.21	0.22	0.21	0.21	0.01
Fe	67.64	66.48	60.84	69.95	66.23	15.07	42.99	41.2	35.44	45.51	41.29	4.28
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	5.34	4.82	5.89	4.77	5.21	0.52	4.72	4.16	4.78	4.33	4.50	0.30
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.74	0.69	0.76	0.64	0.71	0.05	0.85	0.77	0.8	0.75	0.79	0.04
S	0.37	0.32	0.36	0.39	0.36	0.02	0.41	0.35	0.37	0.44	0.39	0.04
Mg	0.00	0.33	0.00	0.00	0.08	-	0.00	0.47	0.00	0.00	0.12	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-12 Experiment 1 % wt of Element and % Atomic of No. 3 (1300°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	9.5	0.00	0.00	2.38	4.75	0.00	23.52	0.00	0.00	5.88	11.76
O	16.75	18.43	22.72	19.64	19.39	2.52	38.36	34.25	46.58	42.55	40.44	5.32
Al	3.43	2.32	4.07	3.72	3.39	0.76	4.66	2.56	4.95	4.78	4.24	1.12
Si	4.13	3.28	5.45	4.54	4.35	0.90	5.39	3.47	6.37	5.61	5.21	1.23
K	0.19	0.19	0.26	0.31	0.24	0.06	0.17	0.14	0.22	0.27	0.20	0.06
Fe	69.08	58.86	59.21	64.65	62.95	4.87	45.31	31.33	34.78	40.12	37.89	6.13
Zr	0.00	2.06	0.00	0.00	0.52	1.03	0.00	0.67	0.00	0.00	0.17	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	5.42	4.93	6.9	5.55	5.70	0.84	4.95	3.65	5.65	4.8	4.76	0.83
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.66	0	0.95	0.72	0.58	0.41	0.78	0	1.01	0.81	0.65	0.45
S	0.34	0.44	0.43	0.51	0.43	0.07	0.38	0.4	0.44	0.55	0.44	0.08
Mg	0.00	0.00	0.00	0.36	0.09	0.18	0.00	0.00	0.00	0.52	0.13	0.26
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-13 Experiment 1 % wt of Element and % Atomic of No. 4 (1200°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	8.37	5.61	1.96	1.76	4.43	3.17	18.05	12.71	4.73	4.53	10.01	6.58
O	30.05	29.7	29.53	25.11	28.60	2.34	48.62	50.48	53.51	48.53	50.29	2.33
Al	1.54	1.66	1.64	1.84	1.67	0.12	1.48	1.68	1.76	2.11	1.76	0.26
Si	3.96	4.16	4.71	4.92	4.44	0.45	3.65	4.02	4.86	5.41	4.49	0.80
K	0.32	0.35	0.36	0.27	0.33	0.04	0.21	0.25	0.27	0.21	0.24	0.03
Fe	47.27	49.23	52.01	56.8	51.33	4.13	21.91	23.97	27	31.45	26.08	4.14
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	6.21	6.96	7.18	7.38	6.93	0.51	4.01	4.72	5.19	5.7	4.91	0.72
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.18	1.39	1.6	1.17	1.34	0.20	0.99	1.22	1.49	1.17	1.22	0.21
S	0.26	0.29	0.22	0.25	0.26	0.03	0.21	0.25	0.2	0.24	0.23	0.02
Mg	0.00	0.00	0.26	0.00	0.09	0.15	0.00	0.00	0.31	0.00	0.10	0.18
Na	0.66	0.51	0.53	0.48	0.55	0.08	0.74	0.61	0.67	0.65	0.67	0.05
Cl	0.17	0.13	0.00	0.00	0.08	0.09	0.12	0.1	0.00	0.00	0.06	0.06
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-14 Experiment 1 % wt of Element and % Atomic of No. 4 (1200°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.35	0.79	0.00	0.93	0.52	0.42	0.9	0.125	0.00	2.33	0.84	1.07
O	26.85	22.04	28.47	27.46	26.21	2.86	51.45	46.42	54.25	51.45	50.89	3.26
Al	2.79	2.26	2.09	2.71	2.46	0.34	3.18	2.83	2.37	3.01	2.85	0.35
Si	6.21	4.77	4.66	6.08	5.43	0.83	6.78	5.72	5.06	6.49	6.01	0.78
K	0.35	0.3	0.31	0.38	0.34	0.04	0.27	0.26	0.24	0.29	0.27	0.02
Fe	49.87	62.86	53.82	51.67	54.56	5.77	27.38	37.93	29.38	27.74	30.61	4.96
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	9.81	6.38	8.49	8.59	8.32	1.42	7.5	5.37	6.46	6.42	6.44	0.87
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.38	0.98	1.57	1.35	1.32	0.25	1.37	1.07	1.54	1.3	1.32	0.19
S	0.33	0.39	0.2	0.29	0.30	0.08	0.32	0.41	0.19	0.28	0.30	0.09
Mg	0.00	0.79	0.00	0.25	0.26	0.37	0.00	0.125	0.00	0.31	0.11	0.15
Na	0.46	0.43	0.39	0.29	0.39	0.07	0.61	0.58	0.51	0.38	0.38	0.10
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-15 Experiment 1 % wt of Element and % Atomic of No. 4 (1200°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
O	26.23	28.01	23.53	25.97	25.94	1.84	50.69	52.91	49.27	52.02	51.22	1.59
Al	2.92	2.96	1.43	1.72	2.26	0.80	3.34	3.32	1.78	2.04	2.62	0.83
Si	6.47	6.5	3.13	4.4	5.13	1.65	7.12	7	3.73	5.02	5.72	1.64
K	0.5	0.75	0.36	0.31	0.48	0.20	0.39	0.58	0.31	0.26	0.39	0.14
Fe	52.67	52.05	65.55	60.62	57.72	6.52	29.16	28.17	39.33	34.79	32.86	5.20
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	9	7.41	4.24	5.7	6.59	2.07	6.94	5.59	3.55	4.56	5.16	1.45
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.42	1.36	0.8	0.8	1.10	0.34	1.42	1.33	0.87	0.82	1.11	0.31
S	0.36	0.31	0.55	0.48	0.43	0.11	0.34	0.29	0.57	0.48	0.42	0.13
Mg	0.00	0.28	0.00	0.00	0.07	0.14	0.00	0.35	0.00	0.00	0.09	0.18
Na	0.44	0.36	0.41	0.00	0.30	0.20	0.59	0.47	0.6	0.00	0.42	0.28
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-16 Experiment 1 % wt of Element and % Atomic of No. 5 (1100°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	4.44	1.11	2.22	0.00	0.00	0.00	11.21	2.80	5.61
O	28.54	29.01	22.09	26.17	26.45	3.16	55.61	55.81	46.95	49.56	51.98	4.43
Al	1.24	1.32	1.49	0.77	1.21	0.31	1.44	1.5	1.88	0.87	1.42	0.42
Si	2.84	3.44	4.06	1.57	2.98	1.06	3.16	3.77	4.92	1.7	3.39	1.34
K	0.25	0.29	0.24	0.00	0.20	0.13	0.2	0.23	0.21	0.00	0.16	0.11
Fe	59.95	57.02	64.48	63.57	61.26	3.44	33.46	31.42	39.26	34.48	34.66	3.32
Zr	0.00	0.00	0.00	1.24	0.31	0.62	0.00	0.00	0.00	0.41	0.10	0.21
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	5.52	7.01	6.37	1.82	5.18	2.32	4.3	5.38	5.4	1.38	4.12	1.89
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.16	1.66	1.01	0.00	0.96	0.70	1.17	1.65	1.11	0.00	0.98	0.70
S	0.00	0.26	0.26	0.41	0.23	0.17	0.00	0.25	0.28	0.39	0.23	0.16
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.49	0.00	0.00	0.00	0.12	0.25	0.67	0.00	0.00	0.00	0.17	0.34
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-17 Experiment 1 % wt of Element and % Atomic of No. 5 (1100°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	9.56	0.00	2.39	4.78	0.00	0.00	22.89	0.00	5.72	11.45
O	28.16	26.62	22.18	26.73	25.92	2.59	54.36	52.72	39.87	53.19	50.04	6.81
Al	1.81	1.56	0.69	1.35	1.35	0.48	2.08	1.83	0.73	1.6	1.56	0.59
Si	4.39	3.96	2.02	3.53	3.48	1.03	4.83	4.47	2.07	4	3.84	1.23
K	0.21	0.32	0.23	0.22	0.25	0.05	0.17	0.26	0.17	0.18	0.20	0.04
Fe	56.72	59.35	60.53	60.47	59.27	1.78	31.36	33.68	31.17	34.47	32.67	1.66
Zr	0.00	0.00	1.45	0.00	0.36	0.73	0.00	0.00	0.46	0.00	0.12	0.23
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	6.98	6.42	2.79	6.29	5.62	1.91	5.37	5.08	2	5	4.36	1.58
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.14	1.12	0.00	1.07	0.83	0.56	1.14	1.14	0.00	1.1	0.85	0.56
S	0.23	0.21	0.17	0.00	0.15	0.10	0.22	0.21	0.16	0.00	0.15	0.10
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.35	0.45	0.39	0.33	0.38	0.05	0.48	0.62	0.49	0.46	0.51	0.07
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-18 Experiment 1 % wt of Element and % Atomic of No. 5 (1100°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	11.48	0.00	0.00	0.00	2.87	5.74	25.02	0.00	0.00	0.00	6.26	12.51
O	27.5	25.9	22.83	23.53	24.94	2.15	45	52.75	49.05	48.97	48.94	3.17
Al	0.6	1.4	1.1	1.57	1.17	0.43	0.58	1.69	1.4	1.94	1.40	0.59
Si	1.54	3.35	2.94	4.11	2.99	1.08	1.44	3.88	3.6	4.87	3.45	1.44
K	0.21	0.00	0.23	0.27	0.18	0.12	0.14	0.00	0.2	0.23	0.14	0.10
Fe	54.74	64.05	65.57	62.51	61.72	4.82	25.66	37.36	40.37	37.28	35.17	6.50
Zr	1.08	0.00	1.99	0.00	0.77	0.96	0.31	0.00	0.75	0.00	0.27	0.35
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	2.84	5.31	5.09	6.65	4.97	1.58	1.85	4.31	4.37	5.52	4.01	1.55
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.51	0.13	0.26	0.00	0.00	0.00	0.27	0.07	0.14
P	0.00	0.00	0.00	0.85	0.21	0.43	0.00	0.00	0.00	0.91	0.23	0.46
S	0.00	0.00	0.26	0.00	0.07	0.13	0.00	0.00	0.28	0.00	0.07	0.14
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-19 Experiment 1 % wt of Element and % Atomic of No. 6 (1000°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	4.93	4.09	1.35	2.41	3.20	1.62	12.76	10.25	3.69	6.5	8.30	4.01
O	22.55	25.03	22.76	23.22	23.39	1.13	43.85	47.06	46.78	47.07	46.19	1.57
Al	0.91	1.15	1.42	1.25	1.18	0.21	1.05	1.29	1.74	1.5	1.40	0.29
Si	2.03	3.21	2.96	2.3	2.63	0.55	2.25	3.44	3.47	2.65	2.95	0.60
K	0.00	0.00	0.43	0.00	0.11	0.22	0.00	0.00	0.36	0.00	0.09	0.18
Fe	64.15	58.12	63.52	62.29	62.02	2.71	35.73	31.3	37.41	36.17	35.15	2.67
Zr	0.00	0.00	0.00	1.84	0.46	0.92	0.00	0.00	0.00	0.65	0.16	0.33
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	4.79	6.7	6.14	6.5	6.03	0.86	3.72	5.03	5.04	5.26	4.76	0.70
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.64	1.51	1.42	0.00	0.89	0.71	0.64	1.46	1.51	0.00	0.90	0.72
S	0.00	0.18	0.00	0.19	0.09	0.11	0.00	0.17	0.00	0.2	0.09	0.11
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-20 Experiment 1 % wt of Element and % Atomic of No. 6 (1000°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.94	3.5	3.96	7.03	4.61	1.63	9.92	9.91	9.96	18.08	11.97	4.08
O	25.32	17.11	25.23	21.63	22.32	3.88	47.86	36.4	47.69	41.73	43.42	5.48
Al	1.26	1.38	1.26	0.52	1.11	0.39	1.42	1.74	1.41	0.6	1.29	0.49
Si	2.58	3.28	2.76	0.37	2.25	1.29	2.78	3.97	2.97	0.41	2.53	1.51
K	0.00	0.00	0.00	0.17	0.04	0.09	0.00	0.00	0.00	0.13	0.03	0.07
Fe	59.49	65.99	59.1	66.13	62.68	3.91	32.22	40.23	32	36.55	35.25	3.93
Zr	0.00	0.00	0.00	1.81	0.45	0.91	0.00	0.00	0.00	0.61	0.15	0.31
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	6.37	7.47	6.07	1.4	5.33	2.69	4.81	6.35	4.58	1.07	4.20	2.23
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.39	0.00	0.10	0.20	0.00	0.00	0.19	0.00	0.05	0.10
P	0.84	1.28	1.23	0.00	0.84	0.59	0.82	1.4	1.2	0.00	0.86	0.62
S	0.2	0.00	0.00	0.19	0.10	0.11	0.18	0.00	0.00	0.18	0.09	0.10
Mg	0.00	0.00	0.00	0.4	0.10	0.20	0.00	0.00	0.00	0.17	0.04	0.09
Na	0.00	0.00	0.00	0.35	0.09	0.18	0.00	0.00	0.00	0.48	0.12	0.24
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

E.1.3 Experiment 2

Table E-21 Experiment 2 % wt of Element and % Atomic of No. 1 Iron nuggets (1500°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.70	1.84	2.67	0.00	2.05	1.57	13.98	7.27	10.33	0.00	7.90	5.94
O	2.88	3.43	3.10	0.00	2.35	1.58	8.18	10.17	9.00	0.00	6.84	4.63
Al	0.41	0.00	0.00	0.57	0.25	0.29	0.69	0.00	0.00	1.15	0.46	0.56
Si	0.72	0.31	0.26	0.60	0.47	0.22	1.17	0.53	0.43	1.16	0.82	0.40
K	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Fe	90.52	90.39	89.32	94.58	91.20	2.31	73.57	76.69	74.22	92.25	79.18	8.81
Zr	0.00	0.00	0.00	1.62	0.41	0.81	0.00	0.00	0.00	0.97	0.24	0.49
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	0.39	0.00	0.00	0.00	0.10	0.20	0.44	0.00	0.00	0.00	0.11	0.22
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.84	1.04	0.00	0.47	0.55	0.00	0.63	0.76	0.00	0.35	0.40
P	0.39	0.50	0.77	0.00	0.42	0.32	0.58	0.77	1.15	0.00	0.63	0.48
S	0.99	2.68	2.84	2.64	2.29	0.87	1.40	3.96	4.11	4.48	3.49	1.41
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-22 Experiment 2 % wt of Element and % Atomic of No. 1 Iron nuggets (1500°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	2.32	0.00	3.73	1.51	1.84	0.00	9.40	0.00	14.99	6.10	7.40
O	0.00	1.72	0.00	0.00	0.43	0.86	0.00	5.23	0.00	0.00	1.31	2.62
Al	0.00	0.00	0.37	0.38	0.19	0.22	0.00	0.00	0.76	0.68	0.36	0.42
Si	0.34	0.31	0.38	0.38	0.35	0.03	0.66	0.55	0.75	0.66	0.66	0.08
K	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Fe	96.82	93.67	95.80	93.68	94.99	1.58	96.18	81.78	96.41	80.93	88.83	8.63
Zr	1.57	0.00	1.60	0.00	0.79	0.92	0.95	0.00	0.99	0.00	0.49	0.56
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.00	0.46	0.00	0.00	0.12	0.23	0.00	0.72	0.00	0.00	0.18	0.36
S	1.27	1.52	0.00	1.82	1.15	0.80	2.20	2.32	0.00	2.74	1.82	1.23
Mg	0.00	0.00	1.86	0.00	0.47	0.93	0.00	0.00	1.09	0.00	0.27	0.55
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-23 Experiment 2 % wt of Element and % Atomic of No. 1 Iron nuggets (1500°C, 50 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.64	1.30	1.81	1.92	0.68	10.16	5.44	7.55	7.72	2.36
O	3.64	2.10	1.28	2.34	1.20	10.50	6.59	4.00	7.03	3.27
Al	0.33	0.34	0.00	0.22	0.19	0.56	0.63	0.00	0.40	0.35
Si	0.33	0.35	0.41	0.36	0.04	0.54	0.62	0.72	0.63	0.09
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	90.87	92.00	94.68	92.52	1.96	75.14	82.85	84.85	80.95	5.13
Zr	0.00	2.24	0.00	0.75	1.29	0.00	1.23	0.00	0.41	0.71
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.33	0.00	0.00	0.11	0.19	0.38	0.00	0.00	0.13	0.22
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.53	0.00	0.40	0.31	0.28	0.79	0.00	0.65	0.48	0.42
S	1.34	1.68	1.43	1.48	0.18	1.93	2.63	2.23	2.26	0.35
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-24 Experiment 2 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	1.68	2.21	2.68	1.83	2.10	0.45	7.21	9.29	11.09	7.86	8.86	1.72
O	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Si	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
K	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Fe	95.82	94.53	94.13	96.18	95.17	0.99	88.65	85.47	83.84	88.86	86.71	2.46
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.80	1.97	2.16	1.24	1.79	-	3.00	3.21	3.47	2.07	2.94	-
S	0.70	1.29	1.03	0.75	0.94	0.27	1.13	2.03	1.60	1.20	1.49	0.42
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-25 Experiment 2 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	2.49	2.58	1.27	1.46	0.00	0.00	10.36	10.76	5.28	6.10
O	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Si	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
K	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Fe	95.64	98.69	94.32	94.89	95.89	1.95	92.48	97.69	84.53	85.20	89.98	6.28
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	2.88	0.77	2.25	1.53	1.86	0.91	5.02	1.38	3.64	2.47	3.13	1.56
S	1.48	0.54	0.94	1.00	0.99	0.39	2.50	0.92	1.47	1.57	1.62	0.66
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-26 Experiment 2 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.40	1.99	2.15	2.24	2.20	0.17	10.09	8.49	9.18	9.43	9.30	0.66
O	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Si	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
K	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Fe	94.97	95.63	96.46	94.78	95.46	0.76	85.70	87.62	88.55	85.80	86.92	1.40
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	1.52	1.70	0.81	1.40	1.36	0.39	2.47	2.80	1.34	2.28	2.22	0.63
S	1.10	0.68	0.58	1.57	0.98	0.45	1.73	1.09	0.93	2.48	1.56	0.71
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-27 Experiment 2 % wt of Element and % Atomic of No. 3 (1400°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	4.10	4.37	3.24	0.83	3.14	1.61	12.10	13.26	10.00	2.81	9.54	4.69
O	14.30	11.83	14.37	14.00	13.63	1.21	31.69	26.92	33.35	35.36	31.83	3.60
Al	1.62	1.93	1.07	0.24	1.22	0.74	2.14	2.60	1.47	0.36	1.64	0.97
Si	3.13	3.65	1.34	0.42	2.14	1.51	3.95	4.73	1.77	0.61	2.77	1.91
K	0.32	0.41	0.17	0.00	0.23	0.18	0.29	0.38	0.16	0.00	0.21	0.17
Fe	69.76	69.86	76.24	82.86	74.68	6.24	44.30	45.53	50.67	59.97	50.12	7.12
Zr	1.85	1.94	1.61	1.34	1.69	0.27	0.72	0.77	0.66	0.59	0.69	0.08
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	3.84	4.43	1.69	0.30	2.57	1.91	3.39	4.02	1.57	0.30	2.32	1.70
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.35	0.00	0.00	0.09	0.18	0.00	0.20	0.00	0.00	0.05	0.10
P	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
S	0.57	0.77	0.14	0.00	0.37	0.36	0.63	0.88	0.16	0.00	0.42	0.41
Mg	0.25	0.13	0.13	0.00	0.13	0.10	0.37	0.20	0.20	0.00	0.19	0.15
Na	0.26	0.33	0.00	0.00	0.15	0.17	0.41	0.52	0.00	0.00	0.23	0.27
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-28 Experiment 2 % wt of Element and % Atomic of No. 3 (1400°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	4.15	14.42	3.88	1.44	5.97	5.76	12.54	36.01	11.94	4.98	16.37	13.54
O	13.59	0.72	11.89	11.16	9.34	5.84	30.85	1.07	27.50	28.95	22.09	14.08
Al	1.50	0.00	1.72	0.38	0.90	0.84	2.02	0.00	2.35	0.58	1.24	1.13
Si	2.15	1.52	3.68	0.51	1.97	1.33	2.78	2.16	4.85	0.75	2.64	1.70
K	0.22	0.97	0.41	0.00	0.40	0.42	0.21	0.99	0.39	0.00	0.40	0.43
Fe	73.10	77.57	72.37	85.33	77.09	5.95	47.53	55.51	47.94	63.40	53.60	7.50
Zr	1.86	1.32	1.96	0.00	1.29	0.90	0.74	0.58	0.79	0.00	0.53	0.36
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	2.89	2.63	3.03	0.71	2.32	1.08	2.62	2.62	2.80	0.74	2.20	0.97
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
S	0.29	0.85	0.52	0.47	0.53	0.23	0.33	1.06	0.60	0.61	0.65	0.30
Mg	0.00	0.00	0.17	0.00	0.04	0.09	0.00	0.00	0.26	0.00	0.07	0.13
Na	0.24	0.00	0.36	0.00	0.15	0.18	0.39	0.00	0.57	0.00	0.24	0.29
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-29 Experiment 2 % wt of Element and % Atomic of No. 3 (1400°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	4.25	4.52	0.00	0.00	2.19	2.53	13.50	13.37	0.00	0.00	6.72	7.76
O	9.49	14.15	10.76	15.67	12.52	2.88	22.63	31.40	29.17	38.48	30.42	6.54
Al	1.51	1.32	0.56	0.66	1.01	0.47	2.13	1.74	0.90	0.96	1.43	0.60
Si	3.98	2.57	1.00	1.27	2.21	1.37	5.40	3.25	1.54	1.78	2.99	1.77
K	0.35	0.22	0.24	0.60	0.35	0.17	0.34	0.20	0.26	0.61	0.35	0.18
Fe	75.05	71.40	84.32	77.44	77.05	5.44	51.25	45.40	65.50	54.48	54.16	8.44
Zr	1.67	1.34	1.46	1.35	1.46	0.15	0.70	0.52	0.69	0.58	0.62	0.09
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	1.80	4.02	1.21	2.33	2.34	1.21	1.71	3.57	1.31	2.28	2.22	0.99
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.26	0.00	0.00	0.00	0.07	0.13	0.16	0.00	0.00	0.00	0.04	0.08
P	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
S	1.12	0.31	0.46	0.68	0.64	0.35	1.33	0.34	0.63	0.83	0.78	0.42
Mg	0.13	0.15	0.00	0.00	0.07	0.08	0.20	0.21	0.00	0.00	0.10	0.12
Na	0.40	0.00	0.00	0.00	0.10	0.20	0.66	0.00	0.00	0.00	0.17	0.33
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-30 Experiment 2 % wt of Element and % Atomic of No. 4 (1300°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	5.04	0.89	17.68	15.35	9.74	8.06	15.25	2.83	42.00	37.41	24.37	18.51
O	10.74	14.21	10.61	12.05	11.90	1.67	24.41	33.87	18.91	22.04	24.81	6.45
Al	1.10	1.71	0.86	1.00	1.17	0.37	1.48	2.41	0.91	1.08	1.47	0.67
Si	3.48	2.93	1.87	1.87	2.54	0.80	4.51	3.98	1.90	1.95	3.09	1.36
K	0.57	0.45	0.35	0.36	0.43	0.10	0.53	0.44	0.26	0.27	0.38	0.13
Fe	70.89	73.35	62.98	64.12	67.84	5.07	46.14	50.09	32.18	33.60	40.50	8.96
Zr	0.00	0.00	0.90	0.76	0.42	0.48	0.00	0.00	0.28	0.24	0.13	0.15
Mn	0.43	0.00	0.00	0.00	0.11	0.22	0.29	0.00	0.00	0.00	0.07	0.15
Ca	5.89	5.56	3.91	3.80	4.79	1.09	5.34	5.29	2.78	2.77	4.05	1.47
Ti	0.21	0.00	0.00	0.00	0.05	0.11	0.16	0.00	0.00	0.00	0.04	0.08
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.93	0.39	0.00	0.00	0.33	0.44	1.09	0.47	0.00	0.00	0.39	0.52
S	0.71	0.51	0.71	0.69	0.66	0.10	0.81	0.61	0.63	0.63	0.67	0.09
Mg	0.00	0.00	0.12	0.00	0.03	0.06	0.00	0.00	0.15	0.00	0.04	0.08
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	100.00	-

Table E-31 Experiment 2 % wt of Element and % Atomic of No. 4 (1300°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	4.13	3.60	1.35	6.76	3.96	2.22	12.59	11.29	4.13	19.46	11.87	6.28
O	13.17	12.45	14.12	13.96	13.43	0.77	30.17	29.29	32.40	30.17	30.51	1.33
Al	0.86	0.91	3.60	0.48	1.46	1.44	1.17	1.26	4.89	0.61	1.98	1.96
Si	1.79	1.33	4.50	0.79	2.10	1.65	2.33	1.79	5.89	0.97	2.75	2.17
K	0.00	0.35	0.35	0.17	0.22	0.17	0.00	0.33	0.32	0.15	0.20	0.16
Fe	73.84	77.48	68.88	74.95	73.79	3.61	48.45	52.24	45.29	46.41	48.10	3.06
Zr	0.79	0.00	0.00	0.71	0.38	0.43	0.32	0.00	0.00	0.27	0.15	0.17
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	4.73	3.26	5.72	1.88	3.90	1.68	4.32	3.06	5.24	1.62	3.56	1.57
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.26	0.00	0.00	0.00	0.07	0.13	0.15	0.00	0.00	0.00	0.04	0.08
P	0.00	0.00	0.66	0.00	0.17	0.33	0.00	0.00	0.78	0.00	0.20	0.39
S	0.44	0.62	0.58	0.31	0.49	0.14	0.50	0.73	0.66	0.34	0.56	0.17
Mg	0.00	0.00	0.26	0.00	0.07	0.13	0.00	0.00	0.39	0.00	0.10	0.20
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-32 Experiment 2 % wt of Element and % Atomic of No. 4 (1300°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	18.78	6.78	9.78	11.23	11.64	5.11	43.72	19.39	26.04	29.70	29.71	10.27
O	10.65	13.84	14.02	12.59	12.78	1.55	18.60	29.71	28.01	24.98	25.33	4.89
Al	0.74	0.71	0.89	0.76	0.78	0.08	0.77	0.90	1.06	0.90	0.91	0.12
Si	2.17	1.42	1.48	1.42	1.62	0.37	2.16	1.73	1.69	1.60	1.80	0.25
K	0.57	0.45	0.29	0.41	0.43	0.12	0.41	0.39	0.24	0.33	0.34	0.08
Fe	62.05	73.11	68.95	69.66	68.44	4.63	31.06	44.98	39.48	39.61	38.78	5.75
Zr	0.81	0.80	0.76	0.73	0.78	0.04	0.25	0.30	0.27	0.25	0.27	0.02
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	3.73	2.43	3.25	2.75	3.04	0.57	2.60	2.09	2.59	2.18	2.37	0.27
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
S	0.49	0.47	0.44	0.45	0.46	0.02	0.43	0.51	0.44	0.45	0.46	0.04
Mg	0.00	0.00	0.14	0.00	0.04	0.07	0.00	0.00	0.19	0.00	0.05	0.10
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	100.00	-

Table E-33 Experiment 2 % wt of Element and % Atomic of No. 5 (1200°C, 50 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	27.14	24.14	28.42	26.57	2.20	54.41	49.26	55.33	53.00	3.27
Al	1.49	1.62	1.69	1.60	0.10	1.77	1.96	1.96	1.90	0.11
Si	2.38	5.05	3.53	3.65	1.34	2.72	5.87	3.91	4.17	1.59
K	1.17	0.50	0.79	0.82	0.34	0.96	0.42	0.63	0.67	0.27
Fe	63.44	60.45	59.63	61.17	2.01	36.43	35.34	33.25	35.01	1.62
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	3.34	6.19	4.48	4.67	1.43	2.67	5.04	3.48	3.73	1.20
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.96	0.61	0.52	0.49	0.00	1.01	0.62	0.54	0.51
S	1.04	1.08	0.85	0.99	0.12	1.04	1.10	0.82	0.99	0.15
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-34 Experiment 2 % wt of Element and % Atomic of No. 5 (1300°C, 50 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	25.53	25.50	27.64	26.22	1.23	51.37	52.63	54.71	52.90	1.69
Al	2.31	1.35	1.30	1.65	0.57	2.76	1.65	1.53	1.98	0.68
Si	4.24	3.17	2.90	3.44	0.71	4.86	3.73	3.27	3.95	0.82
K	0.93	0.47	1.16	0.85	0.35	0.77	0.39	0.94	0.70	0.28
Fe	60.66	63.70	59.42	61.26	2.20	34.97	37.66	33.69	35.44	2.03
Zr	0.00	0.00	1.99	0.66	1.15	0.00	0.00	0.69	0.23	0.40
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	5.35	4.05	3.56	4.32	0.93	4.30	3.34	2.81	3.48	0.76
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.98	0.00	1.08	0.69	0.60	0.99	0.00	1.07	0.69	0.60
Mg	0.00	1.76	0.00	0.59	1.02	0.00	0.61	0.00	0.20	0.35
Na	0.00	0.00	0.93	0.31	0.54	0.00	0.00	1.28	0.43	0.74
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-35 Experiment 2 % wt of Element and % Atomic of No. 5 (1300°C, 50 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	28.67	25.52	24.98	26.39	1.99	56.09	51.83	50.20	52.71	3.04
Al	1.53	1.40	2.86	1.93	0.81	1.78	1.68	3.41	2.29	0.97
Si	3.08	4.08	4.50	3.89	0.73	3.43	4.72	5.15	4.43	0.90
K	0.90	0.74	0.70	0.78	0.11	0.72	0.62	0.58	0.64	0.07
Fe	61.74	62.63	59.22	61.20	1.77	34.60	36.44	34.09	35.04	1.24
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	3.10	4.94	6.05	4.70	1.49	2.42	4.00	4.85	3.76	1.23
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.73	0.24	0.42	0.00	0.00	0.75	0.25	0.43
S	0.98	0.69	0.97	0.88	0.16	0.96	0.70	0.97	0.88	0.15
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-36 Experiment 2 % wt of Element and % Atomic of No. 1 Slag (1500°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	8.84	2.21	4.42	0.00	0.00	0.00	18.64	4.66	9.32
O	33.04	36.00	25.64	26.41	30.27	5.06	53.60	56.15	45.99	41.82	49.39	6.64
Al	12.09	13.99	12.46	10.74	12.32	1.34	11.63	12.94	13.25	10.09	11.98	1.44
Si	11.76	11.38	10.29	6.71	10.04	2.30	10.87	10.12	10.51	6.05	9.39	2.25
K	1.42	1.22	2.28	0.78	1.43	0.63	0.94	0.78	1.67	0.51	0.98	0.50
Fe	22.58	18.67	33.37	34.08	27.18	7.74	10.49	8.34	17.15	15.46	12.86	4.13
Zr	0.00	0.00	0.00	1.60	0.40	0.80	0.00	0.00	0.00	0.44	0.11	0.22
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	18.61	18.75	15.96	10.36	15.92	3.92	12.05	11.67	11.42	6.55	10.42	2.59
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.49	0.00	0.00	0.00	0.12	0.25	0.41	0.00	0.00	0.00	0.10	0.21
S	0.00	0.00	0.00	0.23	0.06	0.12	0.00	0.00	0.00	0.18	0.05	0.09
Mg	0.00	0.00	0.00	0.24	0.06	0.12	0.00	0.00	0.00	0.26	0.07	0.13
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-

Table E-37 Experiment 2 % wt of Element and % Atomic of No. 1 Slag (1500°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	4.25	4.52	0.00	0.00	2.19	2.53	13.50	13.37	0.00	0.00	6.72	7.76
O	9.49	14.15	10.76	15.67	12.52	2.88	22.63	31.40	29.17	38.48	30.42	6.54
Al	1.51	1.32	0.56	0.66	1.01	0.47	2.13	1.74	0.90	0.96	1.43	0.60
Si	3.98	2.57	1.00	1.27	2.21	1.37	5.40	3.25	1.54	1.78	2.99	1.77
K	0.35	0.22	0.24	0.60	0.35	0.17	0.34	0.20	0.26	0.61	0.35	0.18
Fe	75.05	71.40	84.32	77.44	77.05	5.44	51.25	45.40	65.50	54.48	54.16	8.44
Zr	1.67	1.34	1.46	1.35	1.46	0.15	0.70	0.52	0.69	0.58	0.62	0.09
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	1.80	4.02	1.21	2.33	2.34	1.21	1.71	3.57	1.31	2.28	2.22	0.99
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.26	0.00	0.00	0.00	0.07	0.13	0.16	0.00	0.00	0.00	0.04	0.08
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	1.12	0.31	0.46	0.68	0.64	0.35	1.33	0.34	0.63	0.83	0.78	0.42
Mg	0.13	0.15	0.00	0.00	0.07	0.08	0.20	0.21	0.00	0.00	0.10	0.12
Na	0.40	0.00	0.00	0.00	0.10	0.20	0.66	0.00	0.00	0.00	0.17	0.33
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-38 Experiment 2 % wt of Element and % Atomic of No. 1 Slag (1500°C, 50 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	7.12	10.92	6.01	6.01	0.00	14.06	23.59	12.55	12.55
O	27.49	31.28	19.74	26.17	26.17	47.57	46.38	32.01	41.99	41.99
Al	12.74	12.68	9.15	11.52	11.52	13.07	11.15	8.80	11.01	11.01
Si	12.07	10.74	5.72	9.51	9.51	11.90	9.07	5.29	8.75	8.75
K	4.41	1.44	2.12	2.66	2.66	3.12	0.88	1.41	1.80	1.80
Fe	24.75	17.29	19.53	20.52	20.52	12.27	7.34	9.07	9.56	9.56
Zr	2.61	1.77	4.01	2.80	2.80	0.79	0.46	1.14	0.80	0.80
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	14.70	16.71	27.55	19.65	19.65	10.16	9.89	17.84	12.63	12.63
Ti	0.47	0.40	0.60	0.49	0.49	0.27	0.20	0.33	0.27	0.27
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.22	0.00	0.65	0.29	0.29	0.19	0.00	0.52	0.24	0.24
Mg	0.00	0.22	0.00	0.07	0.07	0.00	0.22	0.00	0.07	0.07
Na	0.55	0.34	0.00	0.30	0.30	0.66	0.35	0.00	0.34	0.34
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-39 Experiment 2 % wt of Element and % Atomic of No. 2 Slag (1450°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	29.52	10.13	27.74	0.00	16.85	14.24	55.56	26.67	44.76	0.00	31.75	24.29
O	13.23	13.59	26.05	34.13	21.75	10.18	18.70	26.86	31.55	53.91	32.76	15.07
Al	1.28	1.77	1.48	5.59	2.53	2.05	1.08	2.08	1.06	5.23	2.36	1.97
Si	2.73	1.86	4.88	14.84	6.08	5.98	2.20	2.10	3.37	13.35	5.26	5.43
K	0.25	0.00	0.00	0.45	0.18	0.22	0.15	0.00	0.00	0.29	0.11	0.14
Fe	46.42	67.90	7.79	6.53	32.16	30.17	18.79	38.44	2.70	2.96	15.72	16.91
Zr	0.86	0.00	0.00	0.00	0.22	0.43	0.21	0.00	0.00	0.00	0.05	0.11
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	5.02	4.16	23.21	36.49	17.22	15.56	2.83	3.28	11.22	23.01	10.09	9.44
Ti	0.00	0.00	0.00	1.18	0.30	0.59	0.00	0.00	0.00	0.62	0.16	0.31
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
S	0.68	0.57	8.85	0.79	2.72	4.09	0.48	0.57	5.35	0.62	1.76	2.40
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	100.00	-

Table E-40 Experiment 2 % wt of Element and % Atomic of No. 2 Slag (1450°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	31.74	57.41	59.67	58.50	51.83	13.43	53.51	74.80	76.42	75.69	70.11	11.08
O	18.42	14.93	15.74	15.06	16.04	1.63	23.32	14.60	15.13	14.63	16.92	4.27
Al	2.41	1.72	1.65	2.08	1.97	0.35	1.81	1.00	0.94	1.20	1.24	0.40
Si	2.88	2.32	1.02	1.04	1.82	0.93	2.08	1.29	0.56	0.58	1.13	0.72
K	0.60	0.00	0.00	0.00	0.15	0.30	0.31	0.00	0.00	0.00	0.08	0.16
Fe	26.75	8.45	15.11	9.91	15.06	8.30	9.70	2.37	4.16	2.76	4.75	3.39
Zr	0.00	1.45	0.00	1.92	0.84	0.99	0.00	0.25	0.00	0.33	0.15	0.17
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	12.52	10.29	5.04	7.67	8.88	3.24	6.33	4.02	1.94	2.97	3.82	1.88
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
S	4.68	3.44	1.78	3.81	3.43	1.22	2.95	1.68	0.85	1.85	1.83	0.86
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	100.00	-

Table E-41 Experiment 2 % wt of Element and % Atomic No. 2 Slag (1450°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	50.56	0.00	57.10	47.34	38.75	26.15	69.21	0.00	70.95	67.70	51.97	34.67
O	16.76	24.80	23.55	18.92	21.01	3.80	17.22	46.01	21.97	20.31	26.38	13.24
Al	4.16	6.94	1.52	1.20	3.46	2.68	2.54	7.64	0.84	0.76	2.95	3.24
Si	3.35	8.86	1.19	1.58	3.75	3.54	1.96	9.36	0.63	0.96	3.23	4.13
K	0.00	0.88	0.00	0.00	0.22	0.44	0.00	0.67	0.00	0.00	0.17	0.34
Fe	11.98	34.27	8.11	24.88	19.81	12.01	3.53	18.21	2.17	7.65	7.89	7.26
Zr	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Ca	11.78	23.38	5.66	6.09	11.73	8.25	4.83	17.31	2.11	2.61	6.72	7.16
Ti	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
S	1.40	0.88	2.87	0.00	1.29	1.20	0.72	0.81	1.34	0.00	0.72	0.55
Mg	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	100.00	-

E.1.4 Experiment 3

Table E-42 Experiment 3 % wt of Element and % Atomic of No. 1 Iron nuggets (1500°C, 50 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	8.16	2.01	1.67	3.95	3.65	28.98	8.59	6.91	14.83	12.29
O	0.00	0.00	2.24	0.75	1.29	0.00	0.00	6.95	2.32	4.01
Al	0.00	0.00	0.25	0.08	-	0.00	0.00	0.46	0.15	-
Si	0.00	0.00	0.12	0.04	-	0.00	0.00	0.22	0.07	-
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	90.43	96.26	94.23	93.64	2.96	69.10	88.57	83.97	80.55	10.18
Zr	0.00	0.00	0.75	0.25	0.43	0.00	0.00	0.41	0.14	0.24
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.27	0.09	0.16	0.00	0.00	0.33	0.11	0.19
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P	0.71	0.98	0.00	0.56	0.51	0.98	1.63	0.00	0.87	0.82
S	0.70	0.75	0.48	0.64	0.14	0.93	1.21	0.74	0.96	0.24
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-43 Experiment 3 % wt of Element and % Atomic of No. 1 Iron nuggets (1500°C, 50 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	1.86	1.81	7.87	3.85	3.48	7.79	7.52	27.70	14.34	11.57
O	1.08	1.53	1.49	1.37	0.25	3.40	4.77	3.93	4.03	0.69
Al	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Si	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.83	94.58	87.45	92.29	4.19	85.52	84.71	66.19	78.81	10.93
Zr	0.00	0.00	2.06	0.69	-	0.00	0.00	0.95	0.32	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.22	0.07	-	0.00	0.00	0.24	0.08	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.35	0.39	0.32	0.35	0.04	0.28	0.31	0.21	0.27	0.05
P	1.15	0.98	0.00	0.71	0.62	1.87	1.58	0.00	1.15	1.01
S	0.73	0.71	0.59	0.68	0.08	1.14	1.11	0.77	1.01	0.21
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-44 Experiment 3 % wt of Element and % Atomic of No. 1 Iron nuggets (1500°C, 50 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.08	5.61	2.08	3.26	2.04	8.91	20.25	8.65	12.60	6.62
O	0.00	2.52	1.25	1.26	1.26	0.00	6.83	3.92	3.58	3.43
Al	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Si	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	96.53	88.41	95.13	93.36	4.34	88.84	68.66	85.22	80.91	10.76
Zr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.14	0.00	0.05	0.08	0.00	0.15	0.00	0.05	0.09
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.69	0.29	0.33	0.35	0.00	0.47	0.23	0.23	0.24
P	0.68	1.70	0.63	1.00	0.60	1.14	2.38	1.02	1.51	0.75
S	0.70	0.93	0.62	0.75	0.16	1.12	1.26	0.97	1.12	0.15
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-45 Experiment 3 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	8.16	7.87	5.61	7.21	1.40	28.98	27.70	20.25	25.64	4.71	8.16	7.87
O	0.00	1.49	2.52	1.34	1.27	0.00	3.93	6.83	3.59	3.43	0.00	1.49
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Si	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	90.43	87.45	88.41	88.76	1.52	69.10	66.19	68.66	67.98	1.57	90.43	87.45
Zr	0.00	2.06	0.00	0.69	1.19	0.00	0.95	0.00	0.32	0.55	0.00	2.06
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.22	0.14	0.12	0.11	0.00	0.24	0.15	0.13	0.12	0.00	0.22
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.32	0.69	0.34	0.35	0.00	0.21	0.47	0.23	0.24	0.00	0.32
P	0.71	0.00	1.70	0.80	0.85	0.98	0.00	2.38	1.12	1.20	0.71	0.00
S	0.70	0.59	0.93	0.74	0.17	0.93	0.77	1.26	0.99	0.25	0.70	0.59
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-46 Experiment 3 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	5.09	4.03	10.82	6.65	3.65	19.78	16.20	35.19	23.72	10.09	5.09	4.03
O	0.00	0.00	1.03	0.34	0.59	0.00	0.00	2.52	0.84	1.45	0.00	0.00
Al	0.00	0.00	0.06	0.02	0.03	0.00	0.00	0.09	0.03	0.05	0.00	0.00
Si	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	93.46	94.21	86.76	91.48	4.10	78.08	81.47	60.70	73.42	11.14	93.46	94.21
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.49	0.24	0.24	0.25	0.00	0.37	0.15	0.17	0.19	0.00	0.49
P	0.78	0.65	0.51	0.65	0.14	1.17	1.01	0.65	0.94	0.27	0.78	0.65
S	0.67	0.63	0.58	0.63	0.05	0.97	0.95	0.71	0.88	0.14	0.67	0.63
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-47 Experiment 3 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	8.37	8.03	5.45	7.28	1.60	28.86	28.10	20.38	25.78	4.69	8.37	8.03
O	1.40	1.13	1.44	1.32	0.17	3.62	2.96	4.05	3.54	0.55	1.40	1.13
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Si	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	89.21	89.82	92.06	90.36	1.50	66.18	67.57	74.07	69.27	4.21	89.21	89.82
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.54	0.49	0.49	0.51	0.03	0.73	0.67	0.71	0.70	0.03	0.54	0.49
S	0.48	0.53	0.56	0.52	0.04	0.62	0.70	0.78	0.70	0.08	0.48	0.53
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-48 Experiment 3 % wt of Element and % Atomic of No. 3 Iron nuggets (1400°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	1.22	2.70	2.77	2.23	0.88	5.09	11.14	10.83	9.02	3.41	1.22	2.70
O	2.54	0.00	2.36	1.63	1.42	7.97	0.00	6.95	4.97	4.34	2.54	0.00
Al	0.12	0.00	0.00	0.04	0.07	0.23	0.00	0.00	0.08	0.13	0.12	0.00
Si	0.26	0.00	0.30	0.19	0.16	0.46	0.00	0.50	0.32	0.28	0.26	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	92.83	92.90	91.21	92.31	0.96	83.55	82.34	76.84	80.91	3.58	92.83	92.90
Zr	1.92	0.00	0.00	0.64	1.11	1.06	0.00	0.00	0.35	0.61	1.92	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.34	0.00	0.35	0.23	0.20	0.42	0.00	0.41	0.28	0.24	0.34	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.53	0.00	0.18	0.31	0.00	0.41	0.00	0.14	0.24	0.00	0.53
P	0.00	2.43	0.95	1.13	1.22	0.00	3.88	1.44	1.77	1.96	0.00	2.43
S	0.78	1.44	2.06	1.43	0.64	1.23	2.23	3.02	2.16	0.90	0.78	1.44
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-49 Experiment 3 % wt of Element and % Atomic of No. 3 Iron nuggets (1400°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.05	2.17	1.96	2.39	0.58	10.76	8.72	8.31	9.26	1.31	3.05	2.17
O	7.46	2.27	0.00	3.24	3.82	19.75	6.85	0.00	8.87	10.03	7.46	2.27
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Si	0.18	0.14	0.14	0.15	0.02	0.27	0.24	0.26	0.26	0.02	0.18	0.14
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	86.57	92.67	94.82	91.35	4.28	65.65	80.04	86.46	77.38	10.66	86.57	92.67
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.35	0.21	0.00	0.19	0.18	0.37	0.25	0.00	0.21	0.19	0.35	0.21
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.99	1.55	1.48	1.34	0.31	1.35	2.41	2.43	2.06	0.62	0.99	1.55
S	1.40	0.99	1.60	1.33	0.31	1.86	1.49	2.54	1.96	0.53	1.40	0.99
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-50 Experiment 3 % wt of Element and % Atomic of No. 3 Iron nuggets (1400°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	5.45	2.62	1.29	3.12	2.12	19.34	10.67	5.54	11.85	6.98	5.45	2.62
O	3.47	1.30	0.95	1.91	1.37	9.23	3.96	3.06	5.42	3.33	3.47	1.30
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Si	0.14	0.00	0.00	0.05	0.08	0.22	0.00	0.00	0.07	0.13	0.14	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	87.68	94.35	96.30	92.78	4.52	66.90	82.68	89.01	79.53	11.39	87.68	94.35
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.30	0.00	0.00	0.10	0.17	0.32	0.00	0.00	0.11	0.18	0.30	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	1.40	0.72	0.72	0.95	0.39	1.92	1.14	1.19	1.42	0.44	1.40	0.72
S	1.56	1.01	0.74	1.10	0.42	2.08	1.54	1.20	1.61	0.44	1.56	1.01
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-51 Experiment 3 % wt of Element and % Atomic of No. 4 (1375°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.49	0.00	2.80	2.10	1.85	9.62	0.00	9.60	6.41	5.55	3.49	0.00
O	15.00	11.31	8.26	11.52	3.38	31.02	29.28	21.23	27.18	5.22	15.00	11.31
Al	3.43	1.25	1.03	1.90	1.33	4.21	1.92	1.57	2.57	1.43	3.43	1.25
Si	8.21	2.69	2.37	4.42	3.28	9.67	3.96	3.48	5.70	3.44	8.21	2.69
K	0.66	0.24	0.19	0.36	0.26	0.56	0.26	0.20	0.34	0.19	0.66	0.24
Fe	51.37	79.45	80.51	70.44	16.53	30.44	58.94	59.29	49.56	16.56	51.37	79.45
Zr	0.95	0.00	0.82	0.59	0.52	0.34	0.00	0.37	0.24	0.21	0.95	0.00
Mn	0.26	0.00	0.00	0.09	0.15	0.16	0.00	0.00	0.05	0.09	0.26	0.00
Ca	14.85	3.41	3.21	7.16	6.66	12.26	3.52	3.29	6.36	5.11	14.85	3.41
Ti	0.21	0.00	0.00	0.07	0.12	0.14	0.00	0.00	0.05	0.08	0.21	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.28	0.07	0.17	0.17	0.11	0.15	0.05	0.11	0.10	0.05	0.28	0.07
P	0.20	0.58	0.00	0.26	0.29	0.09	0.77	0.00	0.29	0.42	0.20	0.58
S	0.53	1.01	0.52	0.69	0.28	0.55	1.31	0.67	0.84	0.41	0.53	1.01
Mg	0.23	0.00	0.11	0.11	0.12	0.31	0.00	0.19	0.17	0.16	0.23	0.00
Na	0.33	0.00	0.00	0.11	0.19	0.48	0.00	0.00	0.16	0.28	0.33	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-52 Experiment 3 % wt of Element and % Atomic of No. 4 (1375°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.16	0.31	0.00	1.16	1.74	10.78	0.99	0.00	3.92	5.96	3.16	0.31
O	7.27	15.74	12.01	11.67	4.25	18.60	37.56	30.52	28.89	9.58	7.27	15.74
Al	1.77	0.80	1.47	1.35	0.50	2.69	1.13	2.21	2.01	0.80	1.77	0.80
Si	3.05	1.36	2.66	2.36	0.88	4.44	1.84	3.85	3.38	1.36	3.05	1.36
K	0.27	0.20	0.23	0.23	0.04	0.28	0.20	0.24	0.24	0.04	0.27	0.20
Fe	79.07	74.26	77.35	76.89	2.44	57.93	50.76	56.30	55.00	3.76	79.07	74.26
Zr	0.76	0.00	0.00	0.25	0.44	0.34	0.00	0.00	0.11	0.20	0.76	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	3.99	5.14	4.12	4.42	0.63	4.07	4.89	4.18	4.38	0.45	3.99	5.14
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.20	0.13	0.17	0.17	0.04	0.13	0.08	0.11	0.11	0.03	0.20	0.13
P	0.00	0.66	1.38	0.68	0.69	0.00	0.81	1.81	0.87	0.91	0.00	0.66
S	0.13	1.23	0.61	0.66	0.55	0.16	1.47	0.78	0.80	0.66	0.13	1.23
Mg	0.11	0.16	0.00	0.09	0.08	0.19	0.26	0.00	0.15	0.13	0.11	0.16
Na	0.23	0.00	0.00	0.08	0.13	0.40	0.00	0.00	0.13	0.23	0.23	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-53 Experiment 3 % wt of Element and % Atomic of No. 4 (1375°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.84	0.80	0.00	1.55	2.03	11.90	2.45	0.00	4.78	6.28	3.84	0.80
O	13.52	15.51	11.97	13.67	1.77	31.47	35.77	30.63	32.62	2.76	13.52	15.51
Al	0.25	1.59	1.33	1.06	0.71	0.34	2.18	2.02	1.51	1.02	0.25	1.59
Si	0.50	2.84	2.29	1.88	1.22	0.67	3.73	3.34	2.58	1.67	0.50	2.84
K	0.17	0.25	0.23	0.22	0.04	0.16	0.24	0.24	0.21	0.05	0.17	0.25
Fe	76.67	69.26	78.28	74.74	4.81	51.11	45.75	57.37	51.41	5.82	76.67	69.26
Zr	1.16	0.00	0.00	0.39	0.67	0.47	0.00	0.00	0.16	0.27	1.16	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	3.13	6.65	4.04	4.61	1.83	2.91	6.12	4.12	4.38	1.62	3.13	6.65
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.19	0.06	0.11	0.00	0.00	0.12	0.04	0.07	0.00	0.00
P	0.00	2.20	0.78	0.99	1.12	0.00	2.62	1.03	1.22	1.32	0.00	2.20
S	0.60	0.63	0.88	0.70	0.15	0.70	0.72	1.12	0.85	0.24	0.60	0.63
Mg	0.00	0.12	0.00	0.04	0.07	0.00	0.19	0.00	0.06	0.11	0.00	0.12
Na	0.16	0.15	0.00	0.10	0.09	0.26	0.23	0.00	0.16	0.14	0.16	0.15
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-54 Experiment 3 % wt of Element and % Atomic of No. 5 (1350°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	8.01	0.00	0.00	2.67	4.62	21.76	0.00	0.00	7.25	12.56	8.01	0.00
O	15.24	17.13	17.13	16.50	1.09	31.10	40.16	40.16	37.14	5.23	15.24	17.13
Al	0.93	1.14	1.14	1.07	0.12	1.13	1.59	1.59	1.44	0.27	0.93	1.14
Si	1.25	2.26	2.26	1.92	0.58	1.45	3.02	3.02	2.50	0.91	1.25	2.26
K	0.26	0.24	0.24	0.25	0.01	0.21	0.23	0.23	0.22	0.01	0.26	0.24
Fe	69.58	73.62	73.62	72.27	2.33	40.67	49.45	49.45	46.52	5.07	69.58	73.62
Zr	0.62	0.00	0.00	0.21	0.36	0.22	0.00	0.00	0.07	0.13	0.62	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	3.59	4.63	4.63	4.28	0.60	2.93	4.33	4.33	3.86	0.81	3.59	4.63
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.46	0.46	0.31	0.27	0.00	0.55	0.55	0.37	0.32	0.00	0.46
S	0.52	0.38	0.38	0.43	0.08	0.53	0.45	0.45	0.48	0.05	0.52	0.38
Mg	0.00	0.15	0.15	0.10	0.09	0.00	0.23	0.23	0.15	0.13	0.00	0.15
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-55 Experiment 3 % wt of Element and % Atomic of No. 5 (1350°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.39	0.17	16.75	6.77	8.79	10.55	0.55	38.26	11.69	13.05	3.39	0.17
O	13.69	15.22	14.94	14.62	0.81	31.97	37.14	25.62	20.05	12.34	13.69	15.22
Al	0.62	0.88	1.39	0.96	0.39	0.86	1.27	1.41	1.02	0.36	0.62	0.88
Si	0.84	1.11	1.40	1.12	0.28	1.11	1.54	1.37	1.13	0.41	0.84	1.11
K	0.00	0.17	0.49	0.22	0.25	0.00	0.17	0.35	0.17	0.15	0.00	0.17
Fe	78.16	76.99	60.38	71.84	9.94	52.29	53.84	29.67	45.27	13.53	78.16	76.99
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	2.71	4.81	3.80	3.77	1.05	2.52	4.68	2.60	3.27	1.22	2.71	4.81
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.60	0.66	0.85	0.70	0.13	0.70	0.80	0.73	0.74	0.05	0.60	0.66
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-56 Experiment 3 % wt of Element and % Atomic of No. 5 (1350°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	8.55	1.27	1.81	3.88	4.06	24.15	4.10	6.03	11.43	11.06	8.55	1.27
O	12.16	14.46	12.54	13.05	1.23	25.78	35.03	31.38	30.73	4.66	12.16	14.46
Al	0.59	0.83	0.43	0.62	0.20	0.74	1.19	0.64	0.86	0.29	0.59	0.83
Si	0.72	1.70	0.61	1.01	0.60	0.87	2.34	0.87	1.36	0.85	0.72	1.70
K	0.17	0.00	0.00	0.06	0.10	0.15	0.00	0.00	0.05	0.09	0.17	0.00
Fe	72.78	77.99	83.22	78.00	5.22	44.22	54.12	59.64	52.66	7.81	72.78	77.99
Zr	0.64	0.85	0.00	0.50	0.44	0.24	0.36	0.00	0.20	0.18	0.64	0.85
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	3.72	2.68	1.14	2.51	1.30	3.15	2.59	1.14	2.29	1.04	3.72	2.68
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.66	0.22	0.25	0.38	0.25	0.70	0.26	0.31	0.42	0.24	0.66	0.22
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-57 Experiment 3 % wt of Element and % Atomic of No. 6 (1300°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.63	0.00	0.68	0.44	0.38	2.11	0.00	2.31	1.47	1.28	0.63	0.00
O	13.11	10.16	13.97	12.41	2.00	33.19	27.48	35.45	32.04	4.11	13.11	10.16
Al	0.71	0.98	0.12	0.60	0.44	1.06	1.57	0.18	0.94	0.70	0.71	0.98
Si	1.42	1.59	0.00	1.00	0.87	2.05	2.44	0.00	1.50	1.31	1.42	1.59
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	80.56	82.27	83.96	82.26	1.70	58.42	63.72	61.04	61.06	2.65	80.56	82.27
Zr	0.88	1.19	0.60	0.89	0.30	0.39	0.56	0.27	0.41	0.15	0.88	1.19
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	2.51	3.42	0.49	2.14	1.50	2.54	3.69	0.50	2.24	1.62	2.51	3.42
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.19	0.40	0.18	0.26	0.12	0.24	0.54	0.26	0.35	0.17	0.19	0.40
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-58 Experiment 3 % wt of Element and % Atomic of No. 6 (1300°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	2.11	0.00	0.70	1.22	0.00	6.74	0.00	2.25	3.89	0.00	2.11
O	15.76	12.05	16.25	14.69	2.30	36.64	28.91	38.61	34.72	5.13	15.76	12.05
Al	1.77	1.52	1.52	1.60	0.14	2.44	2.17	2.15	2.25	0.16	1.77	1.52
Si	3.13	3.37	2.33	2.94	0.54	4.15	4.60	3.15	3.97	0.74	3.13	3.37
K	0.31	0.00	0.17	0.16	0.16	0.29	0.00	0.16	0.15	0.15	0.31	0.00
Fe	66.00	74.61	74.31	71.64	4.89	43.97	51.26	50.59	48.61	4.03	66.00	74.61
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	9.66	5.37	4.71	6.58	2.69	8.97	5.14	4.47	6.19	2.43	9.66	5.37
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.66	0.00	0.00	0.22	0.38	0.38	0.00	0.00	0.13	0.22	0.66	0.00
P	0.00	0.56	0.48	0.35	0.30	0.00	0.69	0.60	0.43	0.38	0.00	0.56
S	2.72	0.41	0.23	1.12	1.39	3.15	0.49	0.27	1.30	1.60	2.72	0.41
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-59 Experiment 3 % wt of Element and % Atomic of No. 6 (1300°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	1.27	0.42	0.73	0.00	0.00	4.31	1.44	2.49	0.00	0.00
O	14.53	16.15	12.54	14.41	1.81	36.91	37.31	31.94	35.39	2.99	14.53	16.15
Al	0.28	2.21	0.25	0.91	1.12	0.42	3.03	0.38	1.28	1.52	0.28	2.21
Si	0.49	3.78	0.44	1.57	1.91	0.71	4.98	0.63	2.11	2.49	0.49	3.78
K	0.00	0.64	0.00	0.21	0.37	0.00	0.61	0.00	0.20	0.35	0.00	0.64
Fe	82.36	67.45	84.37	78.06	9.24	59.94	44.64	61.55	55.38	9.33	82.36	67.45
Zr	0.70	0.00	0.00	0.23	0.40	0.31	0.00	0.00	0.10	0.18	0.70	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	1.48	8.33	0.96	3.59	4.11	1.50	7.68	0.98	3.39	3.73	1.48	8.33
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.80	0.00	0.27	0.46	0.00	0.96	0.00	0.32	0.55	0.00	0.80
S	0.17	0.45	0.16	0.26	0.16	0.21	0.52	0.21	0.31	0.18	0.17	0.45
Mg	0.00	0.18	0.00	0.06	0.10	0.00	0.27	0.00	0.09	0.16	0.00	0.18
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-60 Experiment 3 % wt of Element and % Atomic of No. 7 (1200°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.75	0.00	1.47	1.41	1.38	8.21	0.00	4.75	4.32	4.12	2.75	0.00
O	16.69	16.02	14.51	15.74	1.12	37.41	37.99	35.23	36.88	1.46	16.69	16.02
Al	0.71	1.27	0.54	0.84	0.38	0.94	1.78	0.78	1.17	0.54	0.71	1.27
Si	1.30	2.69	0.82	1.60	0.97	1.66	3.63	1.13	2.14	1.32	1.30	2.69
K	0.00	0.23	0.00	0.08	0.13	0.00	0.22	0.00	0.07	0.13	0.00	0.23
Fe	74.08	72.89	80.37	75.78	4.02	47.57	49.52	55.89	50.99	4.35	74.08	72.89
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	3.65	5.76	2.29	3.90	1.75	3.27	5.46	2.22	3.65	1.65	3.65	5.76
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.58	0.87	0.00	0.48	0.44	0.67	1.07	0.00	0.58	0.54	0.58	0.87
S	0.25	0.28	0.00	0.18	0.15	0.28	0.33	0.00	0.20	0.18	0.25	0.28
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-61 Experiment 3 % wt of Element and % Atomic of No. 7 (1200°C, 50 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	2.19	2.39	1.53	1.33	0.00	7.04	7.55	4.86	4.22
O	13.78	13.87	14.38	14.01	0.32	35.21	33.50	34.06	34.26	0.87
Al	0.30	0.39	0.55	0.41	0.13	0.46	0.56	0.77	0.60	0.16
Si	0.81	0.75	0.96	0.84	0.11	1.18	1.03	1.29	1.17	0.13
K	0.19	0.00	0.00	0.06	0.11	0.19	0.00	0.00	0.06	0.11
Fe	82.79	80.85	78.79	80.81	2.00	60.58	55.93	53.45	56.65	3.62
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	1.69	1.77	2.51	1.99	0.45	1.72	1.70	2.37	1.93	0.38
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.23	0.08	0.13	0.00	0.00	0.28	0.09	0.16
S	0.26	0.18	0.19	0.21	0.04	0.34	0.22	0.22	0.26	0.07
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.18	0.00	0.00	0.06	0.10	0.32	0.00	0.00	0.11	0.18
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-62 Experiment 3 % wt of Element and % Atomic of No. 7 (1200°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.52	2.40	1.41	1.44	0.94	1.59	7.41	4.32	4.44	2.91	0.52	2.40
O	16.75	14.93	15.74	15.81	0.91	38.84	34.63	36.88	36.78	2.11	16.75	14.93
Al	1.06	0.78	0.84	0.89	0.15	1.46	1.08	1.17	1.24	0.20	1.06	0.78
Si	2.28	1.59	1.60	1.82	0.39	3.01	2.10	2.14	2.42	0.51	2.28	1.59
K	0.39	0.00	0.08	0.16	0.21	0.37	0.00	0.07	0.15	0.20	0.39	0.00
Fe	72.04	75.44	75.78	74.42	2.07	47.85	50.13	50.99	49.66	1.62	72.04	75.44
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	5.68	4.25	3.90	4.61	0.94	5.26	3.94	3.65	4.28	0.86	5.68	4.25
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.71	0.44	0.48	0.54	0.15	0.85	0.52	0.58	0.65	0.18	0.71	0.44
S	0.36	0.18	0.18	0.24	0.10	0.42	0.20	0.20	0.27	0.13	0.36	0.18
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.22	0.00	0.00	0.07	0.13	0.35	0.00	0.00	0.12	0.20	0.22	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-63 Experiment 3 % wt of Element and % Atomic of No. 1 Slag (1500°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.86	0.00	0.00	0.29	0.50	1.73	0.00	0.00	0.58	1.00	0.86	0.00
O	35.66	20.02	36.72	30.80	9.35	53.92	36.10	55.12	48.38	10.65	35.66	20.02
Al	6.85	5.93	8.09	6.96	1.08	6.14	6.34	7.20	6.56	0.56	6.85	5.93
Si	15.94	15.27	18.14	16.45	1.50	13.73	15.69	15.51	14.98	1.08	15.94	15.27
K	1.03	1.05	0.84	0.97	0.12	0.64	0.78	0.51	0.64	0.14	1.03	1.05
Fe	1.91	2.05	1.85	1.94	0.10	0.83	1.06	0.79	0.89	0.15	1.91	2.05
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.81	0.30	0.37	0.41	0.00	0.43	0.13	0.19	0.22	0.00	0.81
Ca	35.16	53.25	32.38	40.26	11.33	21.22	38.33	19.40	26.32	10.44	35.16	53.25
Ti	0.63	0.94	0.50	0.69	0.23	0.32	0.57	0.25	0.38	0.17	0.63	0.94
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.58	0.00	0.00	0.19	0.33	0.22	0.00	0.00	0.07	0.13	0.58	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.34	0.33	0.44	0.37	0.06	0.26	0.30	0.33	0.30	0.04	0.34	0.33
Mg	0.40	0.34	0.48	0.41	0.07	0.40	0.40	0.47	0.42	0.04	0.40	0.34
Na	0.44	0.00	0.26	0.23	0.22	0.46	0.00	0.27	0.24	0.23	0.44	0.00
Cl	0.20	0.00	0.00	0.07	0.12	0.13	0.00	0.00	0.04	0.08	0.20	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-64 Experiment 3 % wt of Element and % Atomic of No. 1 Slag (1500°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	27.62	43.19	31.86	34.22	8.05	46.51	61.87	50.81	53.06	7.92	27.62	43.19
Al	6.82	7.68	7.07	7.19	0.44	6.81	6.53	6.69	6.68	0.14	6.82	7.68
Si	15.74	16.58	16.33	16.22	0.43	15.09	13.53	14.84	14.49	0.84	15.74	16.58
K	0.51	0.35	0.36	0.41	0.09	0.35	0.20	0.23	0.26	0.08	0.51	0.35
Fe	11.01	4.33	5.85	7.06	3.50	5.31	1.78	2.67	3.25	1.84	11.01	4.33
Zr	0.23	0.43	0.27	0.31	0.11	0.10	0.15	0.11	0.12	0.03	0.23	0.43
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	36.38	25.95	36.44	32.92	6.04	24.45	14.84	23.20	20.83	5.23	36.38	25.95
Ti	0.60	0.42	0.54	0.52	0.09	0.34	0.20	0.29	0.28	0.07	0.60	0.42
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.64	0.44	0.69	0.59	0.13	0.54	0.32	0.55	0.47	0.13	0.64	0.44
Mg	0.46	0.63	0.59	0.56	0.09	0.51	0.59	0.62	0.57	0.06	0.46	0.63
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-65 Experiment 3 % wt of Element and % Atomic of No. 1 Slag (1500°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	25.05	1.68	8.91	14.00	0.00	38.78	3.48	14.09	21.46	0.00	25.05
O	46.96	34.75	35.10	38.94	6.95	65.72	40.39	54.75	53.62	12.70	46.96	34.75
Al	8.01	5.11	7.16	6.76	1.49	6.65	3.52	6.62	5.60	1.80	8.01	5.11
Si	14.21	10.49	12.22	12.31	1.86	11.33	6.95	10.86	9.71	2.40	14.21	10.49
K	0.00	0.00	0.85	0.28	0.49	0.00	0.00	0.54	0.18	0.31	0.00	0.00
Fe	7.08	8.05	18.33	11.15	6.23	2.84	2.68	8.19	4.57	3.14	7.08	8.05
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.45	0.15	0.26	0.00	0.00	0.21	0.07	0.12	0.00	0.00
Ca	22.33	16.54	22.35	20.41	3.35	12.48	7.68	13.92	11.36	3.27	22.33	16.54
Ti	0.00	0.00	0.50	0.17	0.29	0.00	0.00	0.26	0.09	0.15	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	1.42	0.00	0.89	0.77	0.72	0.99	0.00	0.69	0.56	0.51	1.42	0.00
Mg	0.00	0.00	0.48	0.16	0.28	0.00	0.00	0.49	0.16	0.28	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-66 Experiment 3 % wt of Element and % Atomic of No. 2 Slag (1450°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	35.95	34.08	41.06	37.03	3.61	52.76	54.43	59.49	55.56	3.50	35.95	34.08
Al	8.05	7.68	7.69	7.81	0.21	7.05	7.23	6.60	6.96	0.32	8.05	7.68
Si	18.50	17.74	17.88	18.04	0.40	15.64	15.96	14.76	15.45	0.62	18.50	17.74
K	1.14	1.15	1.06	1.12	0.05	0.73	0.71	0.63	0.69	0.05	1.14	1.15
Fe	2.87	4.34	2.40	3.20	1.01	1.92	1.25	0.99	1.39	0.48	2.87	4.34
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.42	0.45	0.35	0.41	0.05	0.20	0.19	0.15	0.18	0.03	0.42	0.45
Ca	31.59	32.74	27.98	30.77	2.48	20.23	19.09	16.18	18.50	2.09	31.59	32.74
Ti	0.55	0.58	0.55	0.56	0.02	0.30	0.28	0.27	0.28	0.02	0.55	0.58
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.25	0.45	0.25	0.32	0.12	0.35	0.19	0.18	0.24	0.10	0.25	0.45
Mg	0.44	0.51	0.55	0.50	0.06	0.52	0.44	0.52	0.49	0.05	0.44	0.51
Na	0.24	0.27	0.23	0.25	0.02	0.29	0.26	0.23	0.26	0.03	0.24	0.27
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-67 Experiment 3 % wt of Element and % Atomic of No. 2 Slag (1450°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	34.80	32.43	39.49	35.57	3.59	53.18	51.08	58.14	54.13	3.63	34.80	32.43
Al	7.95	7.19	7.43	7.52	0.39	7.21	6.71	6.49	6.80	0.37	7.95	7.19
Si	18.47	16.81	17.33	17.54	0.85	16.08	15.09	14.53	15.23	0.78	18.47	16.81
K	1.10	1.15	1.02	1.09	0.07	0.69	0.74	0.61	0.68	0.07	1.10	1.15
Fe	1.57	2.54	3.02	2.38	0.74	0.69	1.15	1.27	1.04	0.31	1.57	2.54
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.46	0.00	0.00	0.15	0.27	0.21	0.00	0.00	0.07	0.12	0.46	0.00
Ca	34.25	38.34	30.17	34.25	4.09	20.89	24.11	17.73	20.91	3.19	34.25	38.34
Ti	0.50	0.76	0.44	0.57	0.17	0.25	0.40	0.22	0.29	0.10	0.50	0.76
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.37	0.37	0.33	0.36	0.02	0.29	0.29	0.24	0.27	0.03	0.37	0.37
Mg	0.51	0.42	0.49	0.47	0.05	0.52	0.43	0.48	0.48	0.05	0.51	0.42
Na	0.00	0.00	0.28	0.09	0.16	0.00	0.00	0.28	0.09	0.16	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-68 Experiment 3 % wt of Element and % Atomic of No. 2 Slag (1450°C, 50 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	21.62	39.75	43.46	34.94	11.69	38.51	59.14	61.60	53.08	12.68	21.62	39.75
Al	17.88	6.79	7.50	10.72	6.21	18.89	5.99	6.31	10.40	7.36	17.88	6.79
Si	9.28	15.58	17.69	14.18	4.38	9.42	13.20	14.28	12.30	2.55	9.28	15.58
K	0.00	0.83	0.90	0.58	0.50	0.00	0.50	0.52	0.34	0.29	0.00	0.83
Fe	0.00	5.92	1.60	2.51	3.06	0.00	2.52	0.65	1.06	1.31	0.00	5.92
Zr	8.09	0.00	0.00	2.70	4.67	2.53	0.00	0.00	0.84	1.46	8.09	0.00
Mn	0.00	0.00	0.30	0.10	0.17	0.00	0.00	0.12	0.04	0.07	0.00	0.00
Ca	43.13	30.74	26.67	33.51	8.57	30.66	18.25	15.09	21.33	8.23	43.13	30.74
Ti	0.00	0.00	0.48	0.16	0.28	0.00	0.00	0.23	0.08	0.13	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.00	0.00	0.58	0.19	0.33	0.00	0.00	0.41	0.14	0.24	0.00	0.00
Mg	0.00	0.39	0.55	0.31	0.28	0.00	0.38	0.51	0.30	0.27	0.00	0.39
Na	0.00	0.00	0.27	0.09	0.16	0.00	0.00	0.27	0.09	0.16	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	100.00	-

Table E-69 Experiment 3 % wt of Element and % Atomic of No. 3 Slag (1400°C, 50 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	35.39	33.19	37.60	35.39	2.21	54.18	51.40	58.52	54.70	3.59	35.39	33.19
Al	7.69	8.10	5.90	7.23	1.17	6.98	7.44	5.44	6.62	1.05	7.69	8.10
Si	18.02	18.88	14.07	16.99	2.57	15.71	16.66	12.47	14.95	2.20	18.02	18.88
K	0.72	0.74	0.51	0.66	0.13	0.45	0.47	0.33	0.42	0.08	0.72	0.74
Fe	5.17	1.74	17.65	8.19	8.37	2.27	0.77	7.87	3.64	3.74	5.17	1.74
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.37	0.33	0.30	0.33	0.04	0.17	0.15	0.14	0.15	0.02	0.37	0.33
Ca	31.00	35.41	22.05	29.49	6.81	18.94	21.89	13.70	18.18	4.15	31.00	35.41
Ti	0.51	0.63	0.35	0.50	0.14	0.26	0.33	0.18	0.26	0.08	0.51	0.63
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.81	0.27	0.47	0.00	0.00	0.65	0.22	0.38	0.00	0.00
S	0.44	0.49	0.33	0.42	0.08	0.33	0.38	0.26	0.32	0.06	0.44	0.49
Mg	0.51	0.50	0.43	0.48	0.04	0.52	0.51	0.44	0.49	0.04	0.51	0.50
Na	0.18	0.00	0.00	0.06	0.10	0.19	0.00	0.00	0.06	0.11	0.18	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100	-	100	100	100	100	100	-

Table E-70 Experiment 3 % wt of Element and % Atomic of No. 3 Slag (1400°C, 50 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	37.62	37.74	37.95	37.77	0.17	56.63	56.36	55.88	56.29	0.38	37.62	37.74
Al	8.43	7.96	8.03	8.14	0.25	7.10	7.05	7.43	7.19	0.21	8.43	7.96
Si	18.18	18.41	17.33	17.97	0.57	14.73	15.66	15.38	15.26	0.48	18.18	18.41
K	0.31	0.68	0.39	0.46	0.19	0.24	0.42	0.19	0.28	0.12	0.31	0.68
Fe	1.04	4.05	3.49	2.86	1.60	1.49	1.73	0.44	1.22	0.69	1.04	4.05
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	32.58	29.67	30.99	31.08	1.46	18.46	17.69	19.32	18.49	0.82	32.58	29.67
Ti	0.59	0.56	0.55	0.57	0.02	0.28	0.28	0.29	0.28	0.01	0.59	0.56
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.65	0.39	0.68	0.57	0.16	0.51	0.29	0.48	0.43	0.12	0.65	0.39
Mg	0.60	0.55	0.58	0.58	0.03	0.57	0.54	0.59	0.57	0.03	0.60	0.55
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	100.00	-

Table E-71 Experiment 3 % wt of Element and % Atomic of No. 3 Slag (1400°C, 50 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	5.77	1.92	3.33	0.00	0.00	10.88	3.63	6.28
O	35.77	40.81	34.88	37.15	3.20	54.11	58.88	49.40	54.13	4.74
Al	8.07	8.14	7.57	7.93	0.31	7.24	6.96	6.36	6.85	0.45
Si	18.91	19.01	17.57	18.50	0.80	16.29	15.63	14.17	15.36	1.08
K	0.73	0.60	0.54	0.62	0.10	0.45	0.35	0.31	0.37	0.07
Fe	2.30	1.01	0.74	1.35	0.83	1.00	0.42	0.30	0.57	0.37
Zr	0.00	0.00	0.84	0.28	0.48	0.00	0.00	0.21	0.07	0.12
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	32.65	28.91	30.51	30.69	1.88	19.72	16.65	17.25	17.87	1.63
Ti	0.51	0.49	0.53	0.51	0.02	0.26	0.24	0.25	0.25	0.01
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.46	0.48	0.50	0.48	0.02	0.35	0.35	0.35	0.35	0.00
Mg	0.58	0.56	0.56	0.57	0.01	0.58	0.53	0.52	0.54	0.03
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

E.1.5 Experiment 4

Table E-72 Experiment 4 % wt of Element and % Atomic of No. 1 Iron nuggets (1450°C, 40 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	3.41	3.60	3.09	3.37	0.26	13.25	14.02	12.33	13.20	0.85
O	1.70	1.57	1.27	1.51	0.22	4.98	4.61	3.79	4.46	0.61
Al	0.71	0.46	0.24	0.47	0.24	1.23	0.79	0.43	0.82	0.40
Si	0.70	0.46	0.29	0.48	0.21	1.17	0.77	0.50	0.81	0.34
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	91.64	91.84	92.55	92.01	0.48	76.70	77.00	79.37	77.69	1.46
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.17	0.00	0.00	0.06	0.10	0.19	0.00	0.00	0.06	0.11
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.38	0.44	0.27	0.24	0.00	0.28	0.33	0.20	0.18
P	0.91	0.99	1.27	1.06	0.19	1.37	1.49	1.96	1.61	0.31
S	0.76	0.70	0.85	0.77	0.08	1.11	1.02	1.27	1.13	0.13
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-73 Experiment 4 % wt of Element and % Atomic of No. 1 Iron nuggets (1450°C, 40 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.35	0.00	2.90	1.75	1.54	9.40	0.00	11.43	6.94	6.10
O	1.89	1.62	1.81	1.77	0.14	5.67	5.29	5.37	5.44	0.20
Al	0.73	0.55	0.57	0.62	0.10	1.30	1.07	1.00	1.12	0.16
Si	1.26	1.09	1.15	1.17	0.09	2.15	2.03	1.94	2.04	0.11
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	92.48	95.27	92.04	93.26	1.75	79.59	89.35	78.08	82.34	6.12
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.30	0.32	0.35	0.32	0.03	0.36	0.41	0.41	0.39	0.03
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.10	0.00	0.03	0.06	0.00	0.08	0.00	0.03	0.05
P	0.56	0.61	0.51	0.56	0.05	0.87	1.03	0.77	0.89	0.13
S	0.44	0.45	0.68	0.52	0.14	0.66	0.73	1.00	0.80	0.18
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-74 Experiment 4 % wt of Element and % Atomic of No. 1 Iron nuggets (1450°C, 40 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.11	4.40	4.93	3.81	1.50	8.49	16.59	18.37	14.48	5.27
O	2.00	2.09	1.61	1.90	0.26	6.03	5.92	4.52	5.49	0.84
Al	0.78	0.38	0.66	0.61	0.21	1.39	0.64	1.10	1.04	0.38
Si	1.32	0.60	0.56	0.83	0.43	2.27	0.96	0.89	1.37	0.78
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	92.43	91.13	89.82	91.13	1.31	79.87	73.87	72.01	75.25	4.11
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.44	0.00	0.00	0.15	0.25	0.53	0.00	0.00	0.18	0.31
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.45	0.15	0.26	0.00	0.00	0.32	0.11	0.18
P	0.56	0.80	1.07	0.81	0.26	0.87	1.17	1.54	1.19	0.34
S	0.36	0.60	0.90	0.62	0.27	0.54	0.85	1.26	0.88	0.36
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-75 Experiment 4 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 30 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	8.14	6.83	9.57	8.18	1.37	28.94	25.09	20.58	24.87	4.18	8.14	6.83
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Al	0.00	0.00	0.08	0.03	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Si	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	90.52	91.19	88.90	90.20	1.18	69.23	72.11	77.83	73.06	4.38	90.52	91.19
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.81	1.23	0.81	0.95	0.24	1.12	1.76	0.91	1.26	0.44	0.81	1.23
S	0.53	0.75	0.63	0.64	0.11	0.70	1.04	0.69	0.81	0.20	0.53	0.75
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-76 Experiment 4 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 30 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	9.19	5.32	10.14	8.22	2.55	31.80	44.52	34.30	36.87	6.74	9.19	5.32
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Al	0.00	0.00	0.67	0.22	0.39	0.00	0.00	0.14	0.05	0.08	0.00	0.00
Si	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	89.80	93.60	87.56	90.32	3.05	66.86	54.27	63.72	61.62	6.55	89.80	93.60
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.00	0.12	0.04	0.07	0.00	0.00	0.12	0.04	0.07	0.00	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.35	0.12	0.20	0.00	0.00	0.23	0.08	0.13	0.00	0.00
P	0.51	0.60	0.67	0.59	0.08	0.69	0.66	0.87	0.74	0.11	0.51	0.60
S	0.51	0.48	0.49	0.49	0.02	0.66	0.54	0.62	0.61	0.06	0.51	0.48
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-77 Experiment 4 % wt of Element and % Atomic of No. 2 Iron nuggets (1450°C, 30 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	14.84	7.17	3.62	8.54	5.73	32.69	26.07	14.43	24.40	9.24	14.84	7.17
O	0.00	0.00	0.99	0.33	0.57	0.00	0.00	2.96	0.99	1.71	0.00	0.00
Al	0.00	0.34	0.00	0.11	0.20	0.13	0.55	0.00	0.23	0.29	0.00	0.34
Si	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	84.11	90.22	93.35	89.23	4.70	65.30	70.51	80.11	71.97	7.51	84.11	90.22
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.41	0.00	0.14	0.24	0.00	0.28	0.00	0.09	0.16	0.00	0.41
P	0.57	1.20	0.65	0.81	0.34	1.07	1.69	1.01	1.26	0.38	0.57	1.20
S	0.48	0.66	0.52	0.55	0.09	0.81	0.90	0.77	0.83	0.07	0.48	0.66
Mg	0.00	0.00	0.87	0.29	0.50	0.00	0.00	0.71	0.24	0.41	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-78 Experiment 4 % wt of Element and % Atomic of No. 3 Iron nuggets (1450°C, 20 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.10	2.18	3.39	2.56	0.72	8.90	9.07	13.21	10.39	2.44
O	0.00	0.91	1.75	0.89	0.88	0.00	2.83	5.11	2.65	2.56
Al	0.11	0.21	0.24	0.19	0.07	0.21	0.39	0.42	0.34	0.11
Si	0.25	0.42	0.68	0.45	0.22	0.45	0.75	1.12	0.77	0.34
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.60	94.63	91.34	93.52	1.89	86.03	84.53	76.53	82.36	5.11
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.19	0.28	0.16	0.14	0.00	0.24	0.33	0.19	0.17
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.41	0.14	0.24	0.26	0.14	0.33	0.11	0.18	0.21	0.11
P	1.50	0.70	1.12	1.11	0.40	2.46	1.12	1.70	1.76	0.67
S	1.02	0.61	0.96	0.86	0.22	1.62	0.95	1.41	1.33	0.34
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-79 Experiment 4 % wt of Element and % Atomic of No. 3 Iron nuggets (1450°C, 20 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.43	2.09	1.73	2.08	0.35	9.80	8.36	6.74	8.30	1.53
O	1.46	2.08	3.14	2.23	0.85	4.41	6.24	9.19	6.61	2.41
Al	0.34	0.62	0.89	0.62	0.28	0.61	1.10	1.54	1.08	0.47
Si	0.82	1.25	2.02	1.36	0.61	1.41	2.14	3.37	2.31	0.99
K	0.00	0.00	0.12	0.04	0.07	0.00	0.00	0.15	0.05	0.09
Fe	92.32	91.21	88.61	90.71	1.90	80.05	78.36	74.29	77.57	2.96
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.56	0.91	1.34	0.94	0.39	0.67	1.09	1.56	1.11	0.45
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.19	0.12	0.14	0.15	0.04	0.15	0.09	0.10	0.11	0.03
P	1.07	0.97	0.97	1.00	0.06	1.67	1.51	1.47	1.55	0.11
S	0.81	0.74	0.88	0.81	0.07	1.23	1.11	1.28	1.21	0.09
Mg	0.00	0.00	0.15	0.05	0.09	0.00	0.00	0.29	0.10	0.17
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-80 Experiment 4 % wt of Element and % Atomic of No. 3 Iron nuggets (1450°C, 20 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.60	2.10	2.61	2.44	0.29	10.41	8.59	10.24	9.75	1.01
O	1.62	1.47	2.23	1.77	0.40	4.86	4.49	6.57	5.31	1.11
Al	0.34	0.43	0.51	0.43	0.09	0.61	0.78	0.89	0.76	0.14
Si	0.71	0.74	1.01	0.82	0.17	1.21	1.29	1.70	1.40	0.26
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	92.35	92.84	90.64	91.94	1.16	79.49	81.45	76.63	79.19	2.42
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.62	0.70	0.99	0.77	0.19	0.74	0.85	1.17	0.92	0.22
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.16	0.30	0.15	0.15	0.00	0.12	0.22	0.11	0.11
P	0.85	0.83	0.93	0.87	0.05	1.32	1.31	1.42	1.35	0.06
S	0.92	0.73	0.78	0.81	0.10	1.38	1.12	1.15	1.22	0.14
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-81 Experiment 4 % wt of Element and % Atomic of No. 4 Iron nuggets (1450°C, 10 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.39	4.41	3.27	3.69	0.63	13.80	17.39	13.34	14.84	2.22	3.39	4.41
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Al	0.00	0.12	0.14	0.09	0.08	0.00	0.21	0.25	0.15	0.13	0.00	0.12
Si	0.15	0.22	0.26	0.21	0.06	0.27	0.37	0.46	0.37	0.10	0.15	0.22
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	93.96	92.60	93.83	93.46	0.75	82.34	78.53	82.42	81.10	2.22	93.96	92.60
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.26	0.15	0.14	0.13	0.00	0.31	0.18	0.16	0.16	0.00	0.26
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.38	0.52	0.41	0.44	0.07	0.29	0.39	0.32	0.33	0.05	0.38	0.52
P	1.27	0.97	1.10	1.11	0.15	2.01	1.49	1.74	1.75	0.26	1.27	0.97
S	0.85	0.89	0.85	0.86	0.02	1.29	1.31	1.30	1.30	0.01	0.85	0.89
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-82 Experiment 4 % wt of Element and % Atomic of No. 4 Iron nuggets (1450°C, 10 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.93	4.18	2.51	3.21	0.87	12.20	16.66	10.55	13.14	3.16	2.93	4.18
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Al	0.00	0.00	0.16	0.05	0.09	0.00	0.00	0.29	0.10	0.17	0.00	0.00
Si	0.19	0.23	0.34	0.25	0.08	0.34	0.39	0.60	0.44	0.14	0.19	0.23
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	95.20	94.01	95.01	94.74	0.64	85.08	80.55	85.79	83.81	2.84	95.20	94.01
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.00	0.20	0.07	0.12	0.00	0.00	0.25	0.08	0.14	0.00	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.33	0.00	0.43	0.25	0.23	0.26	0.00	0.34	0.20	0.18	0.33	0.00
P	0.69	0.84	0.69	0.74	0.09	1.10	1.29	1.13	1.17	0.10	0.69	0.84
S	0.66	0.74	0.67	0.69	0.04	1.03	1.11	1.05	1.06	0.04	0.66	0.74
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-83 Experiment 4 % wt of Element and % Atomic of No. 4 Iron nuggets (1450°C, 10 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.18	2.53	2.55	2.42	0.21	9.28	10.66	10.67	10.20	0.80	2.18	2.53
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Al	0.00	0.00	0.10	0.03	0.06	0.00	0.00	0.18	0.06	0.10	0.00	0.00
Si	0.15	0.20	0.25	0.20	0.05	0.28	0.36	0.44	0.36	0.08	0.15	0.20
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	95.75	95.47	94.60	95.27	0.60	87.61	86.43	85.10	86.38	1.26	95.75	95.47
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.34	0.42	0.49	0.42	0.08	0.27	0.33	0.39	0.33	0.06	0.34	0.42
P	0.89	0.73	1.14	0.92	0.21	1.47	1.20	1.86	1.51	0.33	0.89	0.73
S	0.69	0.64	0.87	0.73	0.12	1.09	1.01	1.36	1.15	0.18	0.69	0.64
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-84 Experiment 4 % wt of Element and % Atomic of No. 5 Iron nuggets (1425°C, 30 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.35	2.04	2.28	2.22	0.16	9.89	8.70	9.64	9.41	0.63
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.12	0.04	0.07	0.00	0.00	0.22	0.07	0.13
Si	0.19	0.15	0.23	0.19	0.04	0.35	0.26	0.41	0.34	0.08
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.87	95.86	95.57	95.43	0.51	85.95	87.85	86.82	86.87	0.95
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.44	0.00	0.00	0.15	0.25	0.35	0.00	0.00	0.12	0.20
P	1.22	1.15	0.97	1.11	0.13	2.00	1.90	1.59	1.83	0.21
S	0.93	0.80	0.83	0.85	0.07	1.47	1.28	1.31	1.35	0.10
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-85 Experiment 4 % wt of Element and % Atomic of No. 5 Iron nuggets (1425°C, 30 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	3.28	0.00	2.08	1.79	1.66	13.49	0.00	8.60	7.36	6.83
O	0.00	0.00	1.11	0.37	0.64	0.00	0.00	3.45	1.15	1.99
Al	0.00	0.00	0.28	0.09	0.16	0.00	0.00	0.52	0.17	0.30
Si	0.00	0.00	0.57	0.19	0.33	0.00	0.00	1.01	0.34	0.58
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	95.41	97.68	94.24	95.78	1.75	84.44	95.95	83.81	88.07	6.83
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.28	0.09	0.16	0.00	0.00	0.35	0.12	0.20
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.80	1.38	0.77	0.98	0.34	1.28	2.45	1.23	1.65	0.69
S	0.52	0.94	0.67	0.71	0.21	0.79	1.61	1.04	1.15	0.42
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-86 Experiment 4 % wt of Element and % Atomic of No. 5 Iron nuggets (1425°C, 30 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.10	2.50	1.64	2.08	0.43	8.97	10.51	6.95	8.81	1.79
O	0.00	0.00	0.78	0.26	0.45	0.00	0.00	2.50	0.83	1.44
Al	0.15	0.00	0.17	0.11	0.09	0.28	0.00	0.32	0.20	0.17
Si	0.00	0.20	0.34	0.18	0.17	0.00	0.36	0.61	0.32	0.31
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	95.95	95.91	95.52	95.79	0.24	88.11	86.89	87.29	87.43	0.62
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.19	0.06	0.11	0.00	0.00	0.24	0.08	0.14
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.36	0.00	0.16	0.17	0.18	0.29	0.00	0.13	0.14	0.15
P	0.81	0.81	0.65	0.76	0.09	1.34	1.32	1.07	1.24	0.15
S	0.64	0.58	0.56	0.59	0.04	1.02	0.91	0.89	0.94	0.07
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-87 Experiment 4 % wt of Element and % Atomic of No. 6 Iron nuggets (1425°C, 20 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.81	2.44	3.58	2.94	0.58	11.65	10.23	13.95	11.94	1.88	2.81	2.44
O	0.00	0.00	1.60	0.53	0.92	0.00	0.00	4.66	1.55	2.69	0.00	0.00
Al	0.25	0.14	0.30	0.23	0.08	0.45	0.25	0.52	0.41	0.14	0.25	0.14
Si	0.55	0.23	0.65	0.48	0.22	0.97	0.41	1.08	0.82	0.36	0.55	0.23
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	94.23	95.31	91.52	93.69	1.95	83.91	86.12	76.62	82.22	4.97	94.23	95.31
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.29	0.17	0.30	0.25	0.07	0.36	0.22	0.35	0.31	0.08	0.29	0.17
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.37	0.00	0.30	0.22	0.20	0.29	0.00	0.22	0.17	0.15	0.37	0.00
P	0.82	0.96	0.95	0.91	0.08	1.32	1.56	1.44	1.44	0.12	0.82	0.96
S	0.67	0.76	0.79	0.74	0.06	1.04	1.20	1.16	1.13	0.08	0.67	0.76
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-88 Experiment 4 % wt of Element and % Atomic of No. 6 Iron nuggets (1425°C, 20 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.49	2.44	3.20	2.71	0.43	10.44	10.31	12.60	11.12	1.29	2.49	2.44
O	0.00	0.00	1.55	0.52	0.89	0.00	0.00	4.59	1.53	2.65	0.00	0.00
Al	0.00	0.00	0.37	0.12	0.21	0.00	0.00	0.64	0.21	0.37	0.00	0.00
Si	0.22	0.00	0.64	0.29	0.33	0.40	0.00	1.08	0.49	0.55	0.22	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	94.77	96.14	91.93	94.28	2.15	85.46	87.40	77.92	83.59	5.01	94.77	96.14
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.12	0.00	0.50	0.21	0.26	0.16	0.00	0.59	0.25	0.31	0.12	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.37	0.00	0.20	0.19	0.19	0.29	0.00	0.15	0.15	0.15	0.37	0.00
P	1.21	0.81	0.83	0.95	0.23	1.97	1.32	1.26	1.52	0.39	1.21	0.81
S	0.82	0.61	0.78	0.74	0.11	1.28	0.97	1.16	1.14	0.16	0.82	0.61
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-89 Experiment 4 % wt of Element and % Atomic of No. 6 Iron nuggets (1420°C, 20 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.69	2.88	2.40	2.66	0.24	11.21	11.57	9.83	10.87	0.92	2.69	2.88
O	0.00	1.14	1.12	0.75	0.65	0.00	3.44	3.44	2.29	1.99	0.00	1.14
Al	0.23	0.30	0.27	0.27	0.04	0.42	0.54	0.48	0.48	0.06	0.23	0.30
Si	0.45	0.45	0.40	0.43	0.03	0.81	0.78	0.70	0.76	0.06	0.45	0.45
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	94.48	93.26	93.95	93.90	0.61	84.57	80.72	82.70	82.66	1.93	94.48	93.26
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.29	0.25	0.19	0.24	0.05	0.36	0.30	0.23	0.30	0.07	0.29	0.25
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.40	0.00	0.00	0.13	0.23	0.31	0.00	0.00	0.10	0.18	0.40	0.00
P	0.83	0.95	1.04	0.94	0.11	1.33	1.48	1.65	1.49	0.16	0.83	0.95
S	0.64	0.78	0.63	0.68	0.08	0.99	1.18	0.97	1.05	0.12	0.64	0.78
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-90 Experiment 4 % wt of Element and % Atomic of No. 7 Iron nuggets (1425°C, 15 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.35	2.62	2.81	1.93	1.37	1.41	10.18	10.97	7.52	5.31
O	3.30	2.54	2.07	2.64	0.62	10.03	7.40	6.07	7.83	2.02
Al	0.94	0.62	0.45	0.67	0.25	1.70	1.08	0.78	1.19	0.47
Si	2.06	1.40	1.11	1.52	0.49	3.57	2.33	1.85	2.58	0.89
K	0.15	0.00	0.00	0.05	0.09	0.18	0.00	0.00	0.06	0.10
Fe	89.97	90.11	90.56	90.21	0.31	78.40	75.37	76.03	76.60	1.59
Zr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	1.15	0.74	0.70	0.86	0.25	1.39	0.86	0.82	1.02	0.32
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P	1.04	0.88	1.18	1.03	0.15	1.63	1.32	1.78	1.58	0.23
S	0.86	0.89	0.99	0.91	0.07	1.31	1.30	1.45	1.35	0.08
Mg	0.19	0.00	0.13	0.11	0.10	0.37	0.00	0.25	0.21	0.19
Na	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100	100	100	100	-	100	100	100	100	-

Table E-91 Experiment 4 % wt of Element and % Atomic of No. 7 Iron nuggets (1425°C, 15 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.16	2.41	1.96	2.18	0.23	9.12	9.72	8.08	8.97	0.83
O	0.00	1.49	1.35	0.95	0.82	0.00	4.51	4.16	2.89	2.51
Al	0.21	0.36	0.31	0.29	0.08	0.40	0.65	0.58	0.54	0.13
Si	0.47	0.73	0.73	0.64	0.15	0.85	1.25	1.28	1.13	0.24
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	95.02	92.74	93.58	93.78	1.15	86.48	80.52	82.78	83.26	3.01
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.25	0.48	0.34	0.36	0.12	0.31	0.58	0.42	0.44	0.14
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.27	0.00	0.00	0.09	0.16	0.22	0.00	0.00	0.07	0.13
P	0.98	0.98	1.02	0.99	0.02	1.61	1.53	1.62	1.59	0.05
S	0.63	0.82	0.71	0.72	0.10	1.00	1.24	1.09	1.11	0.12
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-92 Experiment 4 % wt of Element and % Atomic of No. 7 Iron nuggets (1425°C, 15 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.62	2.60	1.14	1.45	1.03	2.60	10.51	4.57	5.89	4.12
O	2.37	1.34	2.85	2.19	0.77	7.42	4.07	8.61	6.70	2.35
Al	0.48	0.23	0.78	0.50	0.28	0.89	0.41	1.41	0.90	0.50
Si	1.01	0.44	1.54	1.00	0.55	1.80	0.75	2.65	1.73	0.95
K	0.10	0.00	0.12	0.07	0.06	0.13	0.00	0.15	0.09	0.08
Fe	91.95	92.55	90.23	91.58	1.20	82.38	80.27	78.08	80.24	2.15
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.77	0.28	1.02	0.69	0.38	0.96	0.34	1.23	0.84	0.46
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.57	0.37	0.13	0.36	0.22	0.45	0.28	0.10	0.28	0.18
P	0.97	1.29	1.14	1.13	0.16	1.57	2.02	1.78	1.79	0.23
S	0.79	0.89	0.87	0.85	0.05	1.23	1.34	1.32	1.30	0.06
Mg	0.15	0.00	0.18	0.11	0.10	0.10	0.00	0.11	0.07	0.06
Na	0.22	0.00	0.00	0.07	0.13	0.48	0.00	0.00	0.16	0.28
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-93 Experiment 4 % wt of Element and % Atomic of No. 8 (1425°C, 10 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.37	0.08	6.12	2.86	3.05	9.41	0.29	17.94	9.21	8.83	2.37	0.08
O	2.42	9.63	12.67	8.24	5.26	7.21	26.04	27.90	20.38	11.45	2.42	9.63
Al	0.68	0.99	0.95	0.87	0.17	1.20	1.59	1.24	1.34	0.21	0.68	0.99
Si	0.55	1.73	1.57	1.28	0.64	0.94	2.67	1.97	1.86	0.87	0.55	1.73
K	0.00	0.16	0.51	0.22	0.26	0.00	0.18	0.46	0.21	0.23	0.00	0.16
Fe	92.41	83.39	73.24	83.01	9.59	79.03	64.61	46.21	63.28	16.45	92.41	83.39
Zr	0.00	0.00	0.85	0.28	0.49	0.00	0.00	0.33	0.11	0.19	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.57	2.21	2.05	1.61	0.90	0.68	2.38	1.80	1.62	0.86	0.57	2.21
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.32	0.41	0.24	0.22	0.00	0.22	0.23	0.15	0.13	0.00	0.32
P	0.42	0.36	0.00	0.26	0.23	0.65	0.51	0.00	0.39	0.34	0.42	0.36
S	0.59	1.13	1.33	1.02	0.38	0.88	1.52	1.46	1.29	0.35	0.59	1.13
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.29	0.10	0.17	0.00	0.00	0.45	0.15	0.26	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-94 Experiment 4 % wt of Element and % Atomic of No. 8 (1425°C, 10 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.28	0.00	0.00	0.76	1.32	8.91	0.00	0.00	2.97	5.14	2.28	0.00
O	3.29	8.40	13.70	8.46	5.21	9.67	23.85	35.28	22.93	12.83	3.29	8.40
Al	0.81	3.61	0.22	1.55	1.81	1.41	6.08	0.33	2.61	3.06	0.81	3.61
Si	0.20	0.00	0.44	0.21	0.22	0.33	0.00	0.65	0.33	0.33	0.20	0.00
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	91.76	83.43	84.30	86.50	4.58	77.22	67.90	62.18	69.10	7.59	91.76	83.43
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.00	0.00	0.69	0.23	0.40	0.00	0.00	0.71	0.24	0.41	0.00	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.50	0.00	0.47	0.32	0.28	0.75	0.00	0.63	0.46	0.40	0.50	0.00
S	1.16	0.00	0.18	0.45	0.62	1.70	0.00	0.23	0.64	0.92	1.16	0.00
Mg	0.00	4.56	0.00	1.52	2.63	0.00	2.16	0.00	0.72	1.25	0.00	4.56
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-95 Experiment 4 % wt of Element and % Atomic of No. 8 (1420°C, 10 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	3.34	1.58	1.53	2.15	1.03	10.87	6.38	6.01	7.75	2.71	3.34	1.58
O	10.20	3.06	4.83	6.03	3.72	24.96	9.25	14.22	16.14	8.03	10.20	3.06
Al	1.12	0.18	0.29	0.53	0.51	1.62	0.31	0.50	0.81	0.71	1.12	0.18
Si	2.14	0.43	0.52	1.03	0.96	2.99	0.74	0.88	1.54	1.26	2.14	0.43
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	79.66	92.85	90.45	87.65	7.03	55.83	80.52	76.34	70.90	13.21	79.66	92.85
Zr	0.00	0.00	1.21	0.40	0.70	0.00	0.00	0.62	0.21	0.36	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	1.93	0.36	0.43	0.91	0.89	1.88	0.44	0.51	0.94	0.81	1.93	0.36
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.24	0.00	0.23	0.16	0.14	0.14	0.00	0.17	0.10	0.09	0.24	0.00
P	0.60	0.44	0.00	0.35	0.31	0.76	0.68	0.00	0.48	0.42	0.60	0.44
S	0.78	1.11	0.51	0.80	0.30	0.95	1.67	0.75	1.12	0.48	0.78	1.11
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-96 Experiment 4 % wt of Element and % Atomic of No. 9 Iron nuggets (1400°C, 40 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.63	1.65	1.64	1.97	0.57	10.43	0.00	6.28	5.57	5.25
O	2.14	0.00	5.04	2.39	2.53	6.35	0.00	14.45	6.93	7.24
Al	0.25	0.00	0.15	0.13	0.13	0.43	0.00	0.25	0.23	0.22
Si	0.00	0.00	0.34	0.11	0.20	0.00	0.00	0.55	0.18	0.32
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	91.85	94.11	89.22	91.73	2.45	78.22	86.11	73.37	79.23	6.43
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.53	0.00	0.34	0.29	0.27	0.62	0.00	0.39	0.34	0.31
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	1.46	1.99	0.31	1.25	0.86	2.24	3.28	0.46	1.99	1.43
S	1.16	2.25	2.97	2.13	0.91	1.71	3.58	4.26	3.18	1.32
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-97 Experiment 4 % wt of Element and % Atomic of No. 9 Iron nuggets (1400°C, 40 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.83	2.09	4.20	3.04	1.07	10.94	8.55	15.54	11.68	3.55
O	2.70	1.33	3.13	2.39	0.94	7.85	4.07	8.71	6.88	2.47
Al	0.00	0.00	0.22	0.07	0.13	0.00	0.00	0.37	0.12	0.21
Si	0.19	0.00	0.20	0.13	0.11	0.31	0.00	0.31	0.21	0.18
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	90.24	93.01	89.25	90.83	1.95	75.11	81.88	71.04	76.01	5.48
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.54	0.24	0.66	0.48	0.22	0.62	0.30	0.73	0.55	0.22
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	1.51	1.57	1.12	1.40	0.24	2.27	2.49	1.61	2.12	0.46
S	1.99	1.76	1.22	1.66	0.40	2.89	2.70	1.69	2.43	0.65
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-98 Experiment 4 % wt of Element and % Atomic of No. 9 Iron nuggets (1400°C, 40 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.19	2.41	2.85	2.48	0.34	8.93	9.49	11.15	9.86	1.15
O	1.49	2.64	2.04	2.06	0.58	4.56	7.81	5.99	6.12	1.63
Al	0.00	0.00	0.17	0.06	0.10	0.00	0.00	0.29	0.10	0.17
Si	0.00	0.00	0.19	0.06	0.11	0.00	0.00	0.33	0.11	0.19
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	93.30	91.21	90.82	91.78	1.33	81.91	77.18	76.51	78.53	2.94
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.29	0.25	0.51	0.35	0.14	0.36	0.30	0.60	0.42	0.16
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	1.17	1.68	1.81	1.55	0.34	1.85	2.56	2.75	2.39	0.47
S	1.56	1.81	1.61	1.66	0.13	2.39	2.67	2.36	2.47	0.17
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-99 Experiment 4 % wt of Element and % Atomic of No. 10 (1400°C, 35 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	1.20	0.00	0.00	0.40	0.69	5.06	0.00	0.00	1.69	2.92	1.20	0.00
O	1.29	14.00	0.00	5.10	7.74	4.08	34.93	0.00	13.00	19.10	1.29	14.00
Al	0.35	0.85	0.30	0.50	0.30	0.66	1.26	0.62	0.85	0.36	0.35	0.85
Si	0.73	1.70	0.54	0.99	0.62	1.32	2.41	1.05	1.59	0.72	0.73	1.70
K	0.00	0.77	0.00	0.26	0.44	0.00	0.78	0.00	0.26	0.45	0.00	0.77
Fe	93.90	78.96	97.64	90.17	9.88	85.05	56.44	96.02	79.17	20.43	93.90	78.96
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.62	1.30	0.51	0.81	0.43	0.79	1.29	0.70	0.93	0.32	0.62	1.30
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.29	0.17	0.15	0.15	0.00	0.18	0.15	0.11	0.10	0.00	0.29
P	0.83	0.69	0.41	0.64	0.21	1.36	0.89	0.73	0.99	0.33	0.83	0.69
S	1.06	1.45	0.43	0.98	0.51	1.68	1.80	0.74	1.41	0.58	1.06	1.45
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-100 Experiment 4 % wt of Element and % Atomic of No. 10 (1400°C, 35 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	1.41	1.50	4.41	2.44	1.71	5.51	6.23	14.64	8.79	5.08	1.41	1.50
O	3.83	1.80	9.20	4.94	3.82	11.25	5.63	22.94	13.27	8.83	3.83	1.80
Al	0.46	0.23	0.15	0.28	0.16	0.81	0.43	0.22	0.49	0.30	0.46	0.23
Si	0.71	0.43	0.31	0.48	0.21	1.19	0.76	0.44	0.80	0.38	0.71	0.43
K	0.00	0.00	0.28	0.09	0.16	0.00	0.00	0.28	0.09	0.16	0.00	0.00
Fe	88.89	93.54	83.18	88.54	5.19	74.88	83.65	59.43	72.65	12.26	88.89	93.54
Zr	0.00	0.00	1.02	0.34	0.59	0.00	0.00	0.45	0.15	0.26	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.99	0.33	0.37	0.56	0.37	1.16	0.41	0.37	0.65	0.45	0.99	0.33
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.38	0.68	0.21	0.42	0.24	0.28	0.53	0.13	0.31	0.20	0.38	0.68
P	0.45	0.62	0.00	0.36	0.32	0.69	1.01	0.00	0.57	0.52	0.45	0.62
S	2.88	0.86	0.88	1.54	1.16	4.23	1.34	1.09	2.22	1.75	2.88	0.86
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-101 Experiment 4 % wt of Element and % Atomic of No. 10 (1420°C, 35 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.50	1.28	1.22	1.00	0.43	2.25	4.08	4.92	3.75	1.37	0.50	1.28
O	0.00	14.24	3.22	5.82	7.47	0.00	34.12	9.71	14.61	17.58	0.00	14.24
Al	0.29	0.81	0.27	0.46	0.31	0.59	1.15	0.48	0.74	0.36	0.29	0.81
Si	0.72	1.61	0.50	0.94	0.59	1.40	2.20	0.86	1.49	0.67	0.72	1.61
K	0.00	1.03	0.00	0.34	0.59	0.00	1.01	0.00	0.34	0.58	0.00	1.03
Fe	97.00	76.46	90.93	88.13	10.55	94.34	52.47	78.62	75.14	21.15	97.00	76.46
Zr	0.86	0.00	0.00	0.29	0.50	0.51	0.00	0.00	0.17	0.29	0.86	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.47	1.26	0.39	0.71	0.48	0.63	1.21	0.46	0.77	0.39	0.47	1.26
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.63	0.43	0.35	0.32	0.00	0.38	0.33	0.24	0.21	0.00	0.63
P	0.16	0.70	0.61	0.49	0.29	0.27	0.87	0.95	0.70	0.37	0.16	0.70
S	0.00	1.63	2.43	1.35	1.24		1.95	3.66	2.81	1.21	0.00	1.63
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.33	0.00	0.11	0.19	0.00	0.56	0.00	0.19	0.32	0.00	0.33
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-102 Experiment 4 % wt of Element and % Atomic of No. 11 (1400°C, 30 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.52	1.72	1.04	1.09	0.60	2.34	7.40	3.97	4.57	2.58	0.52	1.72
O	0.00	0.00	4.83	1.61	2.79	0.00	0.00	13.84	4.61	7.99	0.00	0.00
Al	0.26	0.35	0.92	0.51	0.36	0.52	0.68	1.57	0.92	0.57	0.26	0.35
Si	0.54	0.54	1.18	0.75	0.37	1.04	0.99	1.92	1.32	0.52	0.54	0.54
K	0.00	0.00	0.58	0.19	0.33	0.00	0.00	0.69	0.23	0.40	0.00	0.00
Fe	97.18	95.79	85.08	92.68	6.62	94.59	88.54	69.89	84.34	12.87	97.18	95.79
Zr	0.82	0.00	0.00	0.27	0.47	0.49	0.00	0.00	0.16	0.28	0.82	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.40	0.63	3.22	1.42	1.57	0.55	0.82	3.69	1.69	1.74	0.40	0.63
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.20	0.07	0.12	0.00	0.00	0.14	0.05	0.08	0.00	0.00
P	0.00	0.47	0.48	0.32	0.27	0.00	0.78	0.71	0.50	0.43	0.00	0.47
S	0.29	0.50	2.35	1.05	1.13	0.48	0.80	3.36	1.55	1.58	0.29	0.50
Mg	0.00	0.00	0.12	0.04	0.07	0.00	0.00	0.23	0.08	0.13	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-103 Experiment 4 % wt of Element and % Atomic of No. 11 (1400°C, 30 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	1.13	1.16	1.04	1.11	0.06	4.70	4.64	4.23	4.52	0.26	1.13	1.16
O	2.02	3.97	3.42	3.14	1.01	6.29	11.92	10.46	9.56	2.92	2.02	3.97
Al	0.20	0.00	0.19	0.13	0.11	0.37	0.00	0.35	0.24	0.21	0.20	0.00
Si	0.57	0.25	0.46	0.43	0.16	1.01	0.43	0.80	0.75	0.29	0.57	0.25
K	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	92.83	92.27	93.01	92.70	0.39	82.96	79.43	81.55	81.31	1.78	92.83	92.27
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.48	0.00	0.39	0.29	0.26	0.59	0.00	0.48	0.36	0.31	0.48	0.00
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.34	0.00	0.22	0.19	0.17	0.27	0.00	0.17	0.15	0.14	0.34	0.00
P	0.30	0.96	0.33	0.53	0.37	0.48	1.50	0.52	0.83	0.58	0.30	0.96
S	2.14	1.38	0.93	1.48	0.61	3.34	2.07	1.43	2.28	0.97	2.14	1.38
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-104 Experiment 4 % wt of Element and % Atomic of No. 11 (1400°C, 30 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.56	6.29	0.93	2.59	3.21	2.54	17.80	4.15	8.16	8.38	0.56	6.29
O	0.00	1.42	0.00	0.47	0.82	0.00	2.38	0.00	0.79	1.37	0.00	1.42
Al	0.19	2.70	0.00	0.96	1.51	0.38	4.35	0.00	1.58	2.41	0.19	2.70
Si	0.42	0.41	0.14	0.32	0.16	0.81	0.60	0.28	0.56	0.27	0.42	0.41
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Fe	97.26	82.30	98.14	92.57	8.90	94.72	66.71	94.23	85.22	16.03	97.26	82.30
Zr	0.92	0.00	0.00	0.31	0.53	0.55	0.00	0.00	0.18	0.32	0.92	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	0.34	4.56	0.00	1.63	2.54	0.47	5.15	0.00	1.87	2.85	0.34	4.56
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.16	0.00	0.05	0.09	0.00	0.11	0.00	0.04	0.06	0.00	0.16
P	0.00	1.56	0.41	0.66	0.81	0.00	2.21	0.70	0.97	1.13	0.00	1.56
S	0.31	0.60	0.38	0.43	0.15	0.53	0.69	0.64	0.62	0.08	0.31	0.60
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-105 Experiment 4 % wt of Element and % Atomic of No. 12 (1375°C, 40 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	7.85	0.00	0.00	2.62	4.53	20.72	0.00	0.00	6.91	11.96	7.85	0.00
O	12.33	2.06	4.24	6.21	5.41	24.41	6.66	12.79	14.62	9.02	12.33	2.06
Al	3.18	0.72	1.66	1.85	1.24	3.73	1.39	2.97	2.70	1.19	3.18	0.72
Si	7.80	1.30	2.15	3.75	3.53	8.80	2.39	3.69	4.96	3.39	7.80	1.30
K	0.89	0.15	0.00	0.35	0.48	0.72	0.20	0.00	0.31	0.37	0.89	0.15
Fe	52.58	93.27	88.75	78.20	22.30	29.83	86.39	76.60	64.27	30.23	52.58	93.27
Zr	1.43	0.00	0.00	0.48	0.83	0.50	0.00	0.00	0.17	0.29	1.43	0.00
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	12.98	1.75	2.43	5.72	6.30	10.26	2.26	2.92	5.15	4.44	12.98	1.75
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.11	0.00	0.04	0.06	0.00	0.09	0.00	0.03	0.05	0.00	0.11
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	0.71	0.19	0.00	0.30	0.37	0.70	0.31	0.00	0.34	0.35	0.71	0.19
Mg	0.27	0.44	0.00	0.24	0.22	0.35	0.31	0.00	0.22	0.19	0.27	0.44
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.76	0.25	0.44	0.00	0.00	1.03	0.34	0.59	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-106 Experiment 4 % wt of Element and % Atomic of No. 12 (1375°C, 40 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	2.05	6.92	2.35	3.77	2.73	6.36	20.64	7.81	11.60	7.86	2.05	6.92
O	10.92	8.00	12.21	10.38	2.16	25.41	17.90	30.49	24.60	6.33	10.92	8.00
Al	4.57	2.38	0.21	2.39	2.18	6.30	3.16	0.31	3.26	3.00	4.57	2.38
Si	5.69	4.94	0.52	3.72	2.79	7.54	6.30	0.74	4.86	3.62	5.69	4.94
K	0.46	0.47	0.00	0.31	0.27	0.44	0.43	0.00	0.29	0.25	0.46	0.47
Fe	66.37	67.80	84.49	72.89	10.07	44.23	43.49	60.43	49.38	9.57	66.37	67.80
Zr	0.00	0.92	0.00	0.31	0.53	0.00	0.36	0.00	0.12	0.21	0.00	0.92
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	7.96	8.34	0.22	5.51	4.58	7.39	7.46	0.22	5.02	4.16	7.96	8.34
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.19	0.00	0.00	0.06	0.11	0.11	0.00	0.00	0.04	0.06	0.19	0.00
P	0.44	0.00	0.00	0.15	0.25	0.53	0.00	0.00	0.18	0.31	0.44	0.00
S	1.03	0.23	0.00	0.42	0.54	1.19	0.26	0.00	0.48	0.63	1.03	0.23
Mg	0.33	0.00	0.00	0.11	0.19	0.50	0.00	0.00	0.17	0.29	0.33	0.00
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-107 Experiment 4 % wt of Element and % Atomic of No. 10 (1375°C, 40 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	7.69	0.00	2.56	4.44	0.00	24.75	0.00	8.25	14.29	0.00	7.69
O	15.44	4.70	7.19	9.11	5.62	33.73	11.34	20.22	21.76	11.27	15.44	4.70
Al	3.77	1.18	1.93	2.29	1.33	4.88	1.68	3.22	3.26	1.60	3.77	1.18
Si	8.52	2.34	2.86	4.57	3.43	10.61	3.22	4.58	6.14	3.93	8.52	2.34
K	0.88	0.18	0.00	0.35	0.46	0.79	0.18	0.00	0.32	0.41	0.88	0.18
Fe	53.18	78.99	81.83	71.33	15.79	33.28	54.65	65.91	51.28	16.57	53.18	78.99
Zr	0.00	0.97	1.80	0.92	0.90	0.00	0.41	0.89	0.43	0.45	0.00	0.97
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Ca	15.18	3.27	3.09	7.18	6.93	13.24	3.15	3.47	6.62	5.74	15.18	3.27
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	1.56	0.00	0.00	0.52	0.90	1.76	0.00	0.00	0.59	1.02	1.56	0.00
S	1.07	0.38	0.54	0.66	0.36	1.17	0.46	0.76	0.80	0.36	1.07	0.38
Mg	0.39	0.31	0.00	0.23	0.21	0.55	0.16	0.00	0.24	0.28	0.39	0.31
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cl	0.00	0.00	0.75	0.25	0.43	0.00	0.00	0.95	0.32	0.55	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-108 Experiment 4 % wt of Element and % Atomic of No. 1 Slag (1450°C, 40 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	29.42	32.26	30.89	30.86	1.42	47.70	50.71	49.02	49.14	1.51
Al	7.42	7.59	7.85	7.62	0.22	7.14	7.07	7.39	7.20	0.17
Si	17.26	17.36	18.05	17.56	0.43	15.94	15.55	16.32	15.94	0.39
K	1.71	1.41	1.51	1.54	0.15	1.13	0.91	0.98	1.01	0.11
Fe	3.28	2.85	2.38	2.84	0.45	1.52	1.28	1.08	1.29	0.22
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	39.60	36.84	37.70	38.05	1.41	25.63	23.12	23.88	24.21	1.29
Ti	0.87	0.67	0.60	0.71	0.14	0.47	0.35	0.32	0.38	0.08
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.24	0.29	0.18	0.16	0.00	0.19	0.23	0.14	0.12
Mg	0.44	0.53	0.45	0.47	0.05	0.47	0.55	0.47	0.50	0.05
Na	0.00	0.25	0.28	0.18	0.15	0.00	0.27	0.31	0.19	0.17
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-109 Experiment 4 % wt of Element and % Atomic of No. 1 Slag (1450°C, 40 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.75	0.25	0.43	0.00	0.00	1.59	0.53	0.92
O	28.27	11.38	29.75	23.13	10.21	46.22	23.38	47.26	38.95	13.50
Al	7.51	4.54	7.54	6.53	1.72	7.28	5.53	7.11	6.64	0.97
Si	17.52	11.24	17.81	15.52	3.71	16.32	13.15	16.12	15.20	1.78
K	40.44	1.66	1.46	14.52	22.45	26.39	1.40	0.95	9.58	14.56
Fe	2.67	7.87	2.62	4.39	3.02	1.25	4.63	1.19	2.36	1.97
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.67	63.30	38.07	34.01	31.51	0.37	51.91	24.14	25.47	25.80
Ti	0.56	0.00	0.58	0.38	0.33	0.27	0.00	0.31	0.19	0.17
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	1.62	0.00	0.28	0.63	0.87	1.08	0.00	0.23	0.44	0.57
Mg	0.40	0.00	0.42	0.27	0.24	0.44	0.00	0.44	0.29	0.25
Na	0.35	0.00	0.44	0.26	0.23	0.39	0.00	0.48	0.29	0.26
Cl	0.00	0.00	0.25	0.08	0.14	0.00	0.00	0.18	0.06	0.10
Total	100	100	100	100	-	100	100	100	100	-

Table E-110 Experiment 4 % wt of Element and % Atomic of No. 1 Slag (1450°C, 40 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	2.48	6.38	2.95	3.22	0.00	5.40	13.79	6.40	6.95
O	24.83	25.16	21.53	23.84	2.01	42.28	41.06	34.97	39.44	3.92
Al	6.99	6.83	5.86	6.56	0.61	7.06	6.60	5.65	6.44	0.72
Si	16.63	16.19	14.03	15.62	1.39	16.13	15.05	12.97	14.72	1.61
K	1.46	1.61	1.36	1.48	0.13	1.02	1.08	0.90	1.00	0.09
Fe	3.47	2.99	3.44	3.30	0.27	1.69	1.40	1.60	1.56	0.15
Zr	0.00	0.00	1.61	0.54	0.93	0.00	0.00	0.46	0.15	0.27
Mn	0.60	0.00	0.66	0.42	0.36	0.30	0.00	0.31	0.20	0.18
Ca	44.21	42.64	43.93	43.59	0.84	30.05	27.78	28.47	28.77	1.16
Ti	0.91	0.86	0.67	0.81	0.13	0.52	0.47	0.36	0.45	0.08
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.30	0.34	0.21	0.28	0.07	0.26	0.28	0.17	0.24	0.06
Mg	0.34	0.31	0.31	0.32	0.02	0.38	0.33	0.33	0.35	0.03
Na	0.27	0.33	0.00	0.20	0.18	0.31	0.37	0.00	0.23	0.20
Cl	0.00	0.27	0.00	0.09	0.16	0.00	0.20	0.00	0.07	0.12
Total	100	100	100	100	-	100	100	100	100	-

Table E-111 Experiment 4 % wt of Element and % Atomic of No. 2 Slag (1450°C, 30 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	6.11	2.04	3.53	0.00	0.00	11.82	3.94	6.82	0.00	0.00
O	34.47	30.41	32.69	32.52	2.04	52.88	48.94	47.46	49.76	2.80	34.47	30.41
Al	7.85	7.43	6.95	7.41	0.45	7.14	7.09	5.98	6.74	0.66	7.85	7.43
Si	18.60	17.32	16.39	17.44	1.11	16.25	15.88	13.56	15.23	1.46	18.60	17.32
K	1.07	1.31	1.21	1.20	0.12	0.67	0.86	0.72	0.75	0.10	1.07	1.31
Fe	2.01	4.96	4.22	3.73	1.53	0.88	2.29	1.76	1.64	0.71	2.01	4.96
Zr	0.00	0.00	0.79	0.26	0.46	0.00	0.00	0.20	0.07	0.12	0.00	0.00
Mn	0.41	0.54	0.41	0.45	0.08	0.18	0.25	0.17	0.20	0.04	0.41	0.54
Ca	34.15	36.48	29.95	33.53	3.31	20.91	23.44	17.36	20.57	3.05	34.15	36.48
Ti	0.63	0.63	0.44	0.57	0.11	0.32	0.34	0.21	0.29	0.07	0.63	0.63
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.34	0.27	0.21	0.27	0.07	0.26	0.22	0.15	0.21	0.06	0.34	0.27
Mg	0.49	0.43	0.45	0.46	0.03	0.49	0.45	0.43	0.46	0.03	0.49	0.43
Na	0.00	0.22	0.17	0.13	0.12	0.00	0.25	0.17	0.14	0.13	0.00	0.22
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-112 Experiment 4 % wt of Element and % Atomic of No. 2 Slag (1450°C, 30 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	32.11	36.55	31.32	33.33	2.82	50.78	54.88	49.99	51.88	2.63	32.11	36.55
Al	7.41	7.98	7.30	7.56	0.37	6.94	7.11	6.91	6.99	0.11	7.41	7.98
Si	17.88	18.58	17.63	18.03	0.49	16.10	15.90	16.02	16.01	0.10	17.88	18.58
K	1.31	1.03	1.41	1.25	0.20	0.85	0.63	0.92	0.80	0.15	1.31	1.03
Fe	4.66	1.84	5.58	4.03	1.95	2.11	0.79	2.55	1.82	0.92	4.66	1.84
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.52	0.00	0.48	0.33	0.29	0.24	0.00	0.22	0.15	0.13	0.52	0.00
Ca	34.79	32.40	34.71	33.97	1.36	21.96	19.42	22.11	21.16	1.51	34.79	32.40
Ti	0.57	0.54	0.64	0.58	0.05	0.30	0.27	0.34	0.30	0.04	0.57	0.54
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.28	0.34	0.23	0.28	0.06	0.22	0.26	0.18	0.22	0.04	0.28	0.34
Mg	0.47	0.53	0.47	0.49	0.03	0.49	0.53	0.50	0.51	0.02	0.47	0.53
Na	0.00	0.22	0.23	0.15	0.13	0.00	0.22	0.25	0.16	0.14	0.00	0.22
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-113 Experiment 4 % wt of Element and % Atomic of No. 2 Slag (1450°C, 30 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	27.19	35.19	32.15	31.51	4.04	45.75	53.78	50.59	50.04	4.04	27.19	35.19
Al	6.37	7.68	7.70	7.25	0.76	6.35	6.96	7.19	6.83	0.43	6.37	7.68
Si	15.50	18.35	18.47	17.44	1.68	14.86	15.97	16.56	15.80	0.86	15.50	18.35
K	1.53	1.21	1.27	1.34	0.17	1.05	0.76	0.82	0.88	0.15	1.53	1.21
Fe	6.79	3.61	4.36	4.92	1.66	3.27	1.58	1.96	2.27	0.89	6.79	3.61
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.45	0.48	0.31	0.27	0.00	0.20	0.22	0.14	0.12	0.00	0.45
Ca	41.57	31.95	33.94	35.82	5.08	27.92	19.49	21.32	22.91	4.43	41.57	31.95
Ti	0.68	0.48	0.56	0.57	0.10	0.38	0.24	0.30	0.31	0.07	0.68	0.48
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.00	0.36	0.31	0.22	0.20	0.00	0.27	0.24	0.17	0.15	0.00	0.36
Mg	0.37	0.49	0.53	0.46	0.08	0.41	0.49	0.55	0.48	0.07	0.37	0.49
Na	0.00	0.24	0.23	0.16	0.14	0.00	0.26	0.26	0.17	0.15	0.00	0.24
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-114 Experiment 4 % wt of Element and % Atomic of No. 3 Slag (1450°C, 20 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	35.50	35.07	41.07	37.21	3.35	54.05	53.60	59.54	55.73	3.31
Al	7.84	7.95	7.77	7.85	0.09	7.08	7.21	6.68	6.99	0.28
Si	18.61	18.48	17.75	18.28	0.46	16.14	16.09	14.66	15.63	0.84
K	1.37	1.36	1.24	1.32	0.07	0.86	0.85	0.74	0.82	0.07
Fe	4.01	3.72	3.41	3.71	0.30	1.75	1.63	1.42	1.60	0.17
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.46	0.00	0.15	0.27	0.00	0.20	0.00	0.07	0.12
Ca	31.28	31.30	27.20	29.93	2.36	19.01	19.09	15.74	17.95	1.91
Ti	0.58	0.59	0.48	0.55	0.06	0.29	0.30	0.23	0.27	0.04
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.29	0.23	0.17	0.15	0.00	0.22	0.17	0.13	0.12
Mg	0.49	0.48	0.53	0.50	0.03	0.49	0.48	0.51	0.49	0.02
Na	0.32	0.30	0.32	0.31	0.01	0.34	0.31	0.32	0.32	0.02
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-115 Experiment 4 % wt of Element and % Atomic of No. 3 Slag (1450°C, 20 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	5.77	8.96	6.24	6.99	1.72	11.13	17.26	12.95	13.78	3.15
O	33.06	30.87	26.22	30.05	3.49	47.88	44.63	40.83	44.45	3.53
Al	7.22	5.48	6.42	6.37	0.87	6.20	4.70	5.93	5.61	0.80
Si	16.69	13.19	15.10	14.99	1.75	13.77	10.86	13.40	12.68	1.58
K	1.50	1.31	1.42	1.41	0.10	0.89	0.77	0.91	0.86	0.08
Fe	2.80	5.76	8.26	5.61	2.73	1.16	2.39	3.68	2.41	1.26
Zr	1.00	1.84	1.28	1.37	0.43	0.25	0.47	0.35	0.36	0.11
Mn	0.00	0.72	0.58	0.43	0.38	0.00	0.30	0.26	0.19	0.16
Ca	30.77	30.29	33.19	31.42	1.55	17.79	17.48	20.63	18.63	1.74
Ti	0.48	0.67	0.44	0.53	0.12	0.23	0.32	0.23	0.26	0.05
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.25	0.25	0.17	0.14	0.00	0.18	0.19	0.12	0.11
Mg	0.44	0.40	0.37	0.40	0.04	0.42	0.38	0.38	0.39	0.02
Na	0.26	0.26	0.24	0.25	0.01	0.26	0.26	0.26	0.26	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-116 Experiment 4 % wt of Element and % Atomic of No. 3 Slag (1450°C, 20 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	32.97	34.19	37.59	34.92	2.39	51.32	52.85	55.94	53.37	2.35
Al	7.57	7.42	8.22	7.74	0.43	6.99	6.80	7.25	7.01	0.23
Si	18.54	17.66	19.04	18.41	0.70	16.44	15.55	16.14	16.04	0.45
K	1.47	1.50	1.39	1.45	0.06	0.94	0.95	0.84	0.91	0.06
Fe	2.92	3.78	2.62	3.11	0.60	1.30	1.68	1.12	1.37	0.29
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.49	0.16	0.28	0.00	0.00	0.21	0.07	0.12
Ca	35.02	33.84	29.17	32.68	3.09	21.76	20.88	17.33	19.99	2.35
Ti	0.48	0.57	0.50	0.52	0.05	0.25	0.29	0.25	0.26	0.02
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.26	0.27	0.26	0.26	0.01	0.20	0.21	0.20	0.20	0.01
Mg	0.52	0.48	0.46	0.49	0.03	0.53	0.49	0.45	0.49	0.04
Na	0.23	0.28	0.26	0.26	0.03	0.25	0.30	0.27	0.27	0.03
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-117 Experiment 4 % wt of Element and % Atomic of No. 4 Slag (1450°C, 10 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	6.96	6.66	4.54	3.93	0.00	14.29	13.06	9.12	7.92	0.00	6.96
O	27.90	26.48	31.28	28.55	2.47	46.93	40.79	46.03	44.58	3.32	27.90	26.48
Al	6.79	6.27	6.72	6.59	0.28	6.78	5.73	5.87	6.13	0.57	6.79	6.27
Si	16.09	14.99	15.66	15.58	0.55	15.42	13.16	13.13	13.90	1.31	16.09	14.99
K	1.62	0.19	1.51	1.11	0.80	1.11	0.15	0.91	0.72	0.51	1.62	0.19
Fe	9.92	9.47	6.98	8.79	1.58	4.78	4.18	2.94	3.97	0.94	9.92	9.47
Zr	1.29	1.02	1.03	1.11	0.15	0.38	0.28	0.27	0.31	0.06	1.29	1.02
Mn	0.51	0.57	0.58	0.55	0.04	0.25	0.29	0.25	0.26	0.02	0.51	0.57
Ca	34.60	1.52	28.49	21.54	17.60	23.23	0.96	16.74	13.64	11.45	34.60	1.52
Ti	0.61	32.10	0.51	11.07	18.21	0.34	19.74	0.25	6.78	11.23	0.61	32.10
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mg	0.42	0.43	0.36	0.40	0.04	0.46	0.44	0.35	0.42	0.06	0.42	0.43
Na	0.27	0.00	0.23	0.17	0.15	0.32	0.00	0.23	0.18	0.17	0.27	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-118 Experiment 4 % wt of Element and % Atomic of No. 4 Slag (1450°C, 10 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	38.59	30.78	31.97	33.78	4.21	57.00	49.50	50.25	52.25	4.13	38.59	30.78
Al	7.96	7.46	7.55	7.66	0.27	6.97	7.11	7.03	7.04	0.07	7.96	7.46
Si	18.15	17.74	18.53	18.14	0.40	15.27	16.25	16.59	16.04	0.69	18.15	17.74
K	1.21	1.64	1.52	1.46	0.22	0.73	1.08	0.98	0.93	0.18	1.21	1.64
Fe	2.44	6.97	2.86	4.09	2.50	1.03	3.21	1.29	1.84	1.19	2.44	6.97
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.81	0.00	0.27	0.47	0.00	0.38	0.00	0.13	0.22	0.00	0.81
Ca	30.08	33.32	35.78	33.06	2.86	17.73	21.38	22.45	20.52	2.47	30.08	33.32
Ti	0.43	0.54	0.71	0.56	0.14	0.21	0.29	0.38	0.29	0.09	0.43	0.54
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.29	0.00	0.40	0.23	0.21	0.21	0.00	0.31	0.17	0.16	0.29	0.00
Mg	0.49	0.44	0.44	0.46	0.03	0.47	0.47	0.45	0.46	0.01	0.49	0.44
Na	0.36	0.30	0.25	0.30	0.06	0.37	0.33	0.27	0.32	0.05	0.36	0.30
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-119 Experiment 4 % wt of Element and % Atomic of No. 4 Slag (1450°C, 10 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	30.80	28.62	36.02	31.81	3.80	49.12	47.50	54.51	50.38	3.67	30.80	28.62
Al	7.63	6.95	7.65	7.41	0.40	7.21	6.83	6.86	6.97	0.21	7.63	6.95
Si	18.17	16.64	18.17	17.66	0.88	16.50	15.73	15.66	15.96	0.47	18.17	16.64
K	1.36	1.55	1.33	1.41	0.12	0.89	1.06	0.83	0.93	0.12	1.36	1.55
Fe	4.12	10.69	2.14	5.65	4.48	1.88	5.08	0.93	2.63	2.17	4.12	10.69
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.55	0.00	0.47	0.34	0.30	0.25	0.00	0.21	0.15	0.13	0.55	0.00
Ca	35.59	34.13	32.49	34.07	1.55	22.66	22.61	19.62	21.63	1.74	35.59	34.13
Ti	0.62	0.71	0.54	0.62	0.09	0.33	0.39	0.27	0.33	0.06	0.62	0.71
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.31	0.00	0.34	0.22	0.19	0.25	0.00	0.26	0.17	0.15	0.31	0.00
Mg	0.49	0.43	0.48	0.47	0.03	0.51	0.47	0.48	0.49	0.02	0.49	0.43
Na	0.36	0.29	0.36	0.34	0.04	0.40	0.33	0.38	0.37	0.04	0.36	0.29
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-120 Experiment 4 % wt of Element and % Atomic of No. 5 Slag (1425°C, 30 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	6.69	2.23	3.86	0.00	0.00	12.85	4.28	7.42
O	33.50	37.20	32.61	34.44	2.43	52.64	56.12	47.03	51.93	4.59
Al	7.13	7.67	7.16	7.32	0.30	6.65	6.86	6.13	6.55	0.38
Si	16.50	17.86	16.04	16.80	0.95	14.77	15.35	13.18	14.43	1.12
K	1.44	1.43	1.36	1.41	0.04	0.92	0.88	0.80	0.87	0.06
Fe	6.48	0.44	3.65	3.52	3.02	2.92	0.19	1.51	1.54	1.37
Zr	0.00	5.77	1.48	2.42	3.00	0.00	2.50	0.37	0.96	1.35
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	33.55	28.37	29.53	30.48	2.72	21.05	17.08	17.00	18.38	2.32
Ti	0.58	0.50	0.43	0.50	0.08	0.31	0.25	0.21	0.26	0.05
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.36	0.00	0.37	0.24	0.21	0.29	0.00	0.27	0.19	0.16
Mg	0.46	0.50	0.44	0.47	0.03	0.47	0.50	0.42	0.46	0.04
Na	0.00	0.25	0.24	0.16	0.14	0.00	0.27	0.24	0.17	0.15
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-121 Experiment 4 % wt of Element and % Atomic of No. 5 Slag (1425°C, 30 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	5.30	1.77	3.06	0.00	0.00	10.45	3.48	6.03
O	33.28	30.78	31.85	31.97	1.25	51.59	49.36	47.13	49.36	2.23
Al	7.94	7.77	7.24	7.65	0.37	7.30	7.39	6.35	7.01	0.58
Si	18.45	17.78	16.79	17.67	0.84	16.29	16.24	14.15	15.56	1.22
K	1.46	1.71	1.48	1.55	0.14	0.93	1.12	0.90	0.98	0.12
Fe	2.73	6.31	5.03	4.69	1.81	1.21	2.90	2.13	2.08	0.85
Zr	0.00	0.00	1.04	0.35	0.60	0.00	0.00	0.27	0.09	0.16
Mn	0.00	0.63	0.44	0.36	0.32	0.00	0.29	0.19	0.16	0.15
Ca	34.28	33.66	29.28	32.41	2.73	21.21	21.55	17.29	20.02	2.37
Ti	0.71	0.59	0.69	0.66	0.06	0.37	0.32	0.34	0.34	0.03
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.32	0.00	0.22	0.18	0.16	0.25	0.00	0.16	0.14	0.13
Mg	0.52	0.49	0.43	0.48	0.05	0.53	0.51	0.41	0.48	0.06
Na	0.30	0.28	0.22	0.27	0.04	0.32	0.31	0.23	0.29	0.05
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-122 Experiment 4 % wt of Element and % Atomic of No. 5 Slag (1425°C, 30 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	33.98	39.90	39.31	37.73	3.26	52.37	58.22	57.63	56.07	3.22
Al	7.97	8.14	8.14	8.08	0.10	7.29	7.04	7.07	7.13	0.14
Si	18.18	18.20	18.21	18.20	0.02	15.96	15.13	15.21	15.43	0.46
K	1.30	1.24	1.34	1.29	0.05	0.82	0.74	0.80	0.79	0.04
Fe	2.03	2.33	2.36	2.24	0.18	0.90	0.97	0.99	0.95	0.05
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	34.88	28.91	28.97	30.92	3.43	21.46	16.84	16.95	18.42	2.64
Ti	0.71	0.43	0.48	0.54	0.15	0.37	0.21	0.23	0.27	0.09
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.44	0.00	0.29	0.24	0.22	0.34	0.00	0.21	0.18	0.17
Mg	0.50	0.56	0.56	0.54	0.03	0.51	0.54	0.54	0.53	0.02
Na	0.00	0.30	0.34	0.21	0.19	0.00	0.30	0.35	0.22	0.19
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-123 Experiment 4 % wt of Element and % Atomic of No. 6 Slag (1425°C, 20 min) 1st specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	22.96	31.66	36.43	30.35	6.83	40.94	50.42	55.22	48.86	7.27	22.96	31.66
Al	6.17	7.44	7.89	7.17	0.89	6.52	7.03	7.09	6.88	0.31	6.17	7.44
Si	14.26	17.76	17.98	16.67	2.09	14.49	16.11	15.52	15.37	0.82	14.26	17.76
K	1.81	1.40	1.51	1.57	0.21	1.32	0.91	0.94	1.06	0.23	1.81	1.40
Fe	10.52	6.57	5.41	7.50	2.68	5.37	3.00	2.35	3.57	1.59	10.52	6.57
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	1.05	0.56	0.45	0.69	0.32	0.55	0.26	0.20	0.34	0.19	1.05	0.56
Ca	42.00	33.24	29.01	34.75	6.63	29.89	21.13	17.56	22.86	6.34	42.00	33.24
Ti	0.92	0.61	0.43	0.65	0.25	0.55	0.33	0.22	0.37	0.17	0.92	0.61
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mg	0.32	0.47	0.53	0.44	0.11	0.38	0.50	0.52	0.47	0.08	0.32	0.47
Na	0.00	0.29	0.37	0.22	0.19	0.00	0.32	0.39	0.24	0.21	0.00	0.29
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-124 Experiment 4 % wt of Element and % Atomic of No. 6 Slag (1425°C, 20 min) 2nd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	25.70	19.12	25.29	23.37	3.69	43.97	35.86	43.46	41.10	4.54	25.70	19.12
Al	6.32	5.37	6.65	6.11	0.66	6.41	5.97	6.77	6.38	0.40	6.32	5.37
Si	15.81	13.18	15.84	14.94	1.53	15.41	14.09	15.51	15.00	0.79	15.81	13.18
K	1.79	2.00	1.81	1.87	0.12	1.26	1.53	1.27	1.35	0.15	1.79	2.00
Fe	8.03	11.37	9.10	9.50	1.71	3.93	6.11	4.48	4.84	1.13	8.03	11.37
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	1.15	0.65	0.60	0.58	0.00	0.63	0.32	0.32	0.32	0.00	1.15
Ca	41.24	46.62	39.19	42.35	3.84	28.16	34.91	26.89	29.99	4.31	41.24	46.62
Ti	0.71	0.93	0.57	0.74	0.18	0.40	0.58	0.33	0.44	0.13	0.71	0.93
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	0.00	0.00	0.29	0.10	0.17	0.00	0.00	0.25	0.08	0.14	0.00	0.00
Mg	0.40	0.26	0.37	0.34	0.07	0.45	0.33	0.42	0.40	0.06	0.40	0.26
Na	0.00	0.00	0.25	0.08	0.14	0.00	0.00	0.30	0.10	0.17	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-125 Experiment 4 % wt of Element and % Atomic of No. 6 Slag (1420°C, 20 min) 3rd specimen

Element	% Element						% Atomic					
	1	2	3	4	average	SD	1	2	3	4	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
O	31.57	32.57	27.89	30.68	2.46	50.08	51.15	46.11	49.11	2.66	31.57	32.57
Al	0.52	7.67	7.36	5.18	4.04	0.54	7.14	7.22	4.97	3.83	0.52	7.67
Si	7.87	18.03	17.64	14.51	5.76	7.40	16.13	16.61	13.38	5.18	7.87	18.03
K	1.49	1.58	1.79	1.62	0.15	0.97	1.01	1.21	1.06	0.13	1.49	1.58
Fe	5.91	4.58	5.98	5.49	0.79	2.69	2.06	2.83	2.53	0.41	5.91	4.58
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Mn	0.00	0.00	0.68	0.23	0.39	0.00	0.00	0.33	0.11	0.19	0.00	0.00
Ca	33.47	34.18	37.12	34.92	1.94	21.19	21.43	24.49	22.37	1.84	33.47	34.18
Ti	0.65	0.54	0.71	0.63	0.09	0.34	0.28	0.39	0.34	0.06	0.65	0.54
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
S	18.26	0.34	0.33	6.31	10.35	16.50	0.26	0.27	5.68	9.37	18.26	0.34
Mg	0.00	0.51	0.49	0.33	0.29	0.00	0.52	0.54	0.35	0.31	0.00	0.51
Na	0.26	0.00	0.00	0.09	0.15	0.29	0.00	0.00	0.10	0.17	0.26	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00	0.00
Total	100	100	100	100	100.00	-	100	100	100	100	100.00	-

Table E-126 Experiment 4 % wt of Element and % Atomic of No. 7 Slag (1425°C, 15 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	6.02	0.00	6.26	4.09	3.55	12.73	0.00	13.11	8.61	7.46
O	24.73	25.00	25.12	24.95	0.20	39.24	43.43	39.47	40.71	2.36
Al	6.26	6.43	6.34	6.34	0.09	5.89	6.63	5.91	6.14	0.42
Si	14.99	15.76	15.34	15.36	0.39	13.55	15.59	13.73	14.29	1.13
K	1.64	1.64	1.68	1.65	0.02	1.07	1.17	1.08	1.11	0.06
Fe	8.25	9.96	8.01	8.74	1.06	3.75	4.95	3.60	4.10	0.74
Zr	1.06	1.27	1.12	1.15	0.11	0.29	0.39	0.31	0.33	0.05
Mn	0.60	0.00	0.52	0.37	0.33	0.28	0.00	0.24	0.17	0.15
Ca	35.19	38.74	34.31	36.08	2.35	22.29	26.86	21.52	23.56	2.89
Ti	0.67	0.57	0.53	0.59	0.07	0.36	0.33	0.28	0.32	0.04
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.20	0.22	0.21	0.21	0.01	0.16	0.19	0.16	0.17	0.02
Mg	0.38	0.40	0.35	0.38	0.03	0.40	0.46	0.36	0.41	0.05
Na	0.00	0.00	0.20	0.07	0.12	0.00	0.00	0.22	0.07	0.13
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-127 Experiment 4 % wt of Element and % Atomic of No. 7 Slag (1425°C, 15 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	40.59	42.95	39.87	41.14	1.61	59.44	61.60	58.71	59.92	1.50
Al	7.55	7.56	7.72	7.61	0.10	6.56	6.43	6.74	6.58	0.16
Si	17.59	17.04	17.56	17.40	0.31	14.67	13.92	14.73	14.44	0.45
K	1.19	1.20	1.24	1.21	0.03	0.71	0.71	0.75	0.72	0.02
Fe	5.72	5.20	5.97	5.63	0.39	2.40	2.14	2.52	2.35	0.19
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.46	0.33	0.33	0.37	0.08	0.20	0.14	0.14	0.16	0.03
Ca	25.46	24.24	25.80	25.17	0.82	14.88	13.88	15.16	14.64	0.67
Ti	0.55	0.39	0.40	0.45	0.09	0.27	0.19	0.20	0.22	0.04
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.17	0.25	0.14	0.13	0.00	0.12	0.18	0.10	0.09
Mg	0.54	0.51	0.45	0.50	0.05	0.53	0.48	0.43	0.48	0.05
Na	0.34	0.40	0.43	0.39	0.05	0.35	0.40	0.44	0.40	0.05
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-128 Experiment 4 % wt of Element and % Atomic of No. 7 Slag (1425°C, 15 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	32.94	34.52	36.17	34.54	1.62	51.91	53.44	55.14	53.50	1.62
Al	7.64	7.49	7.72	7.62	0.12	7.14	6.88	6.97	7.00	0.13
Si	17.70	18.03	17.79	17.84	0.17	15.88	15.91	15.45	15.75	0.26
K	1.56	1.44	1.41	1.47	0.08	1.01	0.91	0.88	0.93	0.07
Fe	6.71	6.73	6.80	6.75	0.05	3.03	2.98	2.97	2.99	0.03
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.53	0.00	0.00	0.18	0.31	0.24	0.00	0.00	0.08	0.14
Ca	31.90	30.59	28.89	30.46	1.51	20.06	18.91	17.58	18.85	1.24
Ti	0.64	0.53	0.47	0.55	0.09	0.34	0.27	0.24	0.28	0.05
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.39	0.43	0.47	0.43	0.04	0.40	0.44	0.47	0.44	0.04
Na	0.00	0.24	0.29	0.18	0.16	0.00	0.25	0.31	0.19	0.16
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-129 Experiment 4 % wt of Element and % Atomic of No. 7 Slag (1400°C, 40 min) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	54.55	0.00	0.00	18.18	31.49	77.81	0.00	0.00	25.94	44.92
O	7.23	27.04	16.34	16.87	9.92	7.75	44.77	33.97	28.83	19.04
Al	0.75	7.66	4.37	4.26	3.46	0.48	7.52	5.39	4.46	3.61
Si	1.08	17.75	9.48	9.44	8.34	0.66	16.75	11.22	9.54	8.17
K	5.56	1.20	0.57	2.44	2.72	2.44	0.81	0.48	1.24	1.05
Fe	22.84	3.82	40.35	22.34	18.27	7.01	1.81	24.02	10.95	11.62
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	3.82	40.15	24.29	22.75	18.21	1.63	26.54	20.15	16.11	12.94
Ti	0.00	1.01	0.50	0.50	0.51	0.00	0.56	0.35	0.30	0.28
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	2.44	0.81	1.41	0.00	0.00	2.61	0.87	1.51
S	4.17	0.94	1.37	2.16	1.75	2.23	0.78	1.42	1.48	0.73
Mg	0.00	0.44	0.28	0.24	0.22	0.00	0.47	0.39	0.29	0.25
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-130 Experiment 4 % wt of Element and % Atomic of No. 7 Slag (1400°C, 40 min) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	49.49	46.05	31.85	27.63	0.00	71.06	62.02	44.36	38.68
O	26.78	13.12	24.90	21.60	7.40	46.77	14.14	25.17	28.69	16.60
Al	7.22	1.92	2.80	3.98	2.84	7.48	1.23	1.68	3.46	3.49
Si	16.95	1.48	10.63	9.69	7.78	16.86	0.91	6.12	7.96	8.13
K	0.66	1.55	1.16	1.12	0.45	0.47	0.68	0.48	0.54	0.12
Fe	28.38	19.56	10.71	19.55	8.84	14.20	6.04	3.10	7.78	5.75
Zr	0.00	0.00	0.77	0.26	0.44	0.00	0.00	0.14	0.05	0.08
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	18.16	9.13	2.46	9.92	7.88	12.66	3.93	0.99	5.86	6.07
Ti	0.50	0.00	0.00	0.17	0.29	0.29	0.00	0.00	0.10	0.17
Au	0.00	0:00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.97	3.75	0.32	1.68	1.82	0.84	2.01	0.16	1.00	0.94
Mg	0.38	0.00	0.00	0.13	0.22	0.43	0.00	0.00	0.14	0.25
Na	0.00	0.00	0.21	0.07	0.12	0.00	0.00	0.15	0.05	0.09
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-131 Experiment 4 % wt of Element and % Atomic of No. 7 Slag (1400°C, 40 min) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	2.33	0.78	1.35	0.00	0.00	6.40	2 13	3.70
O	33.56	43.23	16.37	31.05	13.60	51.69	61.09	33.75	48.84	13.89
Al	8.52	8.82	2.66	6.67	3.47	7.78	7.39	3.25	6.14	2.51
Si	19.00	18.60	5.89	14.50	7.46	16.67	14.98	6.92	12.86	5.21
K	1.03	0.00	0.81	0.61	0.54	0.65	0.00	0.47	0.37	0.34
Fe	1.98	2.19	49.65	17.94	27.46	0.87	0.89	29.33	10.36	16.43
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	33.90	25.04	17.04	25.33	8.43	20.84	14.12	14.03	16.33	3.91
Ti	0.70	0.00	0.42	0.37	0.35	0.36	0.00	0.29	0.22	0.19
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	4.09	1.36	2.36	0.00	0.00	4.35	1.45	2.51
S	0.83	0.71	1.32	0.95	0.32	0.63	0.50	1.35	0.83	0.46
Mg	0.49	0.61	0.24	0.45	0.19	0.49	0.57	0.32	0.46	0.13
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

E.1.6 Experiment 5

Table E-132 Experiment 5 % wt of Element and % Atomic of No. 1 (1425°C, 20 min, mole ratio C/Fe = 1.24/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	4.55	3.75	4.96	4.42	0.62	12.77	11.62	14.73	13.04	1.57
O	14.32	10.89	12.83	12.68	1.72	30.19	25.30	28.57	28.02	2.49
Al	2.99	2.22	1.64	2.28	0.68	3.73	3.06	2.17	2.99	0.78
Si	6.62	4.37	2.91	4.63	1.87	7.95	5.78	3.70	5.81	2.13
K	0.56	0.31	0.37	0.41	0.13	0.49	0.30	0.34	0.38	0.10
Fe	63.45	71.21	70.64	68.43	4.33	38.33	47.39	45.07	43.60	4.71
Zr	1.20	1.02	1.16	1.13	0.09	0.45	0.41	0.45	0.44	0.02
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	4.53	5.23	4.75	4.84	0.36	3.82	4.85	4.22	4.30	0.52
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.11	0.04	0.06	0.00	0.00	0.06	0.02	0.03
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.69	0.68	0.62	0.66	0.04	0.73	0.79	0.69	0.74	0.05
Mg	0.45	0.00	0.00	0.15	0.26	0.62	0.00	0.00	0.21	0.36
Na	0.63	0.31	0.00	0.31	0.32	0.93	0.50	0.00	0.48	0.47
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-133 Experiment 5 % wt of Element and % Atomic of No. 1 (1425°C, 20 min, mole ratio C/Fe = 1.24/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	1.25	0.42	0.72	0.00	0.00	5.19	1.73	3.00
O	9.81	14.93	1.57	8.77	6.74	24.33	33.64	4.90	20.96	14.66
Al	2.88	3.27	0.43	2.19	1.54	4.23	4.37	0.80	3.13	2.02
Si	6.43	7.24	1.02	4.90	3.38	9.09	9.30	1.81	6.73	4.27
K	0.61	0.58	0.00	0.40	0.34	0.62	0.53		0.58	0.06
Fe	64.85	58.49	91.51	71.62	17.52	46.07	37.76	81.61	55.15	23.29
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.37	0.00	0.00	0.12	0.21	0.27	0.00	0.00	0.09	0.16
Ca	13.53	13.50	1.34	9.46	7.03	13.40	12.14	1.66	9.07	6.45
Ti	0.00	0.26	0.00	0.09	0.15	0.00	0.20	0.00	0.07	0.12
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.59	0.20	0.34	0.00	0.00	0.46	0.15	0.27
P	0.67	0.89	0.45	0.67	0.22	0.86	1.04	0.72	0.87	0.16
S	0.62	0.59	1.84	1.02	0.71	0.76	0.67	2.86	1.43	1.24
Mg	0.23	0.24	0.00	0.16	0.14	0.38	0.36	0.00	0.25	0.21
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-134 Experiment 5 % wt of Element and % Atomic of No. 1 (1425°C, 20 min, mole ratio C/Fe = 1.24/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	2.33	0.78	1.35	0.00	0.00	6.40	2.13	3.70
O	33.56	43.23	16.37	31.05	13.60	51.69	61.09	33.75	48.84	13.89
Al	8.52	8.82	2.66	6.67	3.47	7.78	7.39	3.25	6.14	2.51
Si	19.00	18.60	5.89	14.50	7.46	16.67	14.98	6.92	12.86	5.21
K	1.03	0.00	0.81	0.61	0.54	0.65	0.00	0.47	0.37	0.34
Fe	1.98	2.19	49.65	17.94	27.46	0.87	0.89	29.33	10.36	16.43
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	33.90	25.04	17.04	25.33	8.43	20.84	14.12	14.03	16.33	3.91
Ti	0.70	0.00	0.42	0.37	0.35	0.36	0.00	0.29	0.22	0.19
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	4.09	1.36	2.36	0.00	0.00	4.35	1.45	2.51
S	0.83	0.71	1.32	0.95	0.32	0.63	0.50	1.35	0.83	0.46
Mg	0.49	0.61	0.24	0.45	0.19	0.49	0.57	0.32	0.46	0.13
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-135 Experiment 5 % wt of Element and % Atomic of No. 2 (1425°C, 20 min, mole ratio C/Fe = 1.34/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	4.78	3.47	3.65	3.97	0.71	15.08	11.11	11.53	12.57	2.18
O	7.21	7.96	10.60	8.59	1.78	17.08	19.16	25.16	20.47	4.20
Al	2.47	2.60	1.70	2.26	0.49	3.48	3.71	2.40	3.20	0.70
Si	5.31	5.69	3.56	4.85	1.14	7.17	7.80	4.81	6.59	1.58
K	0.36	0.43	0.31	0.37	0.06	0.35	0.42	0.30	0.36	0.06
Fe	68.57	68.33	73.06	69.99	2.66	46.57	47.12	49.65	47.78	1.64
Zr	0.96	0.97	0.95	0.96	0.01	0.40	0.41	0.39	0.40	0.01
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	9.15	8.97	4.97	7.70	2.36	8.66	8.62	4.71	7.33	2.27
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.32	0.54	0.26	0.37	0.15	0.19	0.33	0.16	0.23	0.09
P	0.27	0.22	0.47	0.32	0.13	0.14	0.12	0.24	0.17	0.06
S	0.21	0.31	0.25	0.26	0.05	0.24	0.38	0.30	0.31	0.07
Mg	0.17	0.25	0.00	0.14	0.13	0.26	0.39	0.00	0.22	0.20
Na	0.24	0.26	0.21	0.24	0.03	0.39	0.43	0.34	0.39	0.05
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-136 Experiment 5 % wt of Element and % Atomic of No. 2 (1425°C, 20 min, mole ratio C/Fe = 1.34/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	6.29	3.99	11.07	7.12	3.61	17.45	12.03	26.38	18.62	7.25
Al	2.03	1.20	3.61	2.28	1.22	3.34	2.14	5.10	3.53	1.49
Si	4.28	2.41	7.62	4.77	2.64	6.76	4.14	10.34	7.08	3.11
K	0.28	0.15	0.51	0.31	0.18	0.32	0.18	0.50	0.33	0.16
Fe	78.85	87.81	60.79	75.82	13.76	62.61	75.85	41.48	59.98	17.34
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	6.87	3.34	14.50	8.24	5.70	7.60	4.02	13.79	8.47	4.94
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.17	0.16	0.00	0.11	0.10	0.12	0.12	0.00	0.08	0.07
P	0.39	0.26	0.95	0.53	0.37	0.56	0.40	1.17	0.71	0.41
S	0.62	0.55	0.64	0.60	0.05	0.86	0.83	0.76	0.82	0.05
Mg	0.20	0.14	0.31	0.22	0.09	0.37	0.28	0.48	0.38	0.10
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-137 Experiment 5 % wt of Element and % Atomic of No. 2 (1425°C, 20 min, mole ratio C/Fe = 1.34/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	13.61	6.51	14.27	11.46	4.30	31.05	17.89	31.81	26.92	7.83
Al	3.78	2.61	4.09	3.49	0.78	5.12	4.26	5.40	4.93	0.59
Si	8.35	4.70	8.84	7.30	2.26	10.85	7.35	11.23	9.81	2.14
K	0.67	0.28	0.65	0.53	0.22	0.63	0.32	0.59	0.51	0.17
Fe	55.86	76.75	54.70	62.44	12.41	36.51	60.42	34.92	43.95	14.29
Zr	1.48	0.95	0.00	0.81	0.75	0.59	0.46	0.00	0.35	0.31
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	15.32	7.43	15.68	12.81	4.66	13.95	8.15	13.95	12.02	3.35
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.45	0.15	0.26	0.00	0.00	0.52	0.17	0.30
S	0.31	0.52	0.98	0.60	0.34	0.36	0.72	1.09	0.72	0.37
Mg	0.37	0.24	0.34	0.32	0.07	0.55	0.44	0.50	0.50	0.06
Na	0.25	0.00	0.00	0.08	0.14	0.39	0.00	0.00	0.13	0.23
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-138 Experiment 5 % wt of Element and % Atomic of No. 3 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.44/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.20	1.89	1.89	1.99	0.18	8.60	7.80	7.80	8.07	0.46
O	2.84	1.35	1.35	1.85	0.86	8.35	4.18	4.18	5.57	2.41
Al	0.30	0.34	0.34	0.33	0.02	0.52	0.62	0.62	0.59	0.06
Si	0.74	0.67	0.67	0.69	0.04	1.24	1.18	1.18	1.20	0.03
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	89.67	93.56	93.56	92.26	2.25	75.48	82.95	82.95	80.46	4.31
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.39	0.52	0.52	0.48	0.08	0.46	0.64	0.64	0.58	0.10
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.45	0.00	0.00	0.15	0.26	0.33	0.00	0.00	0.11	0.19
P	0.40	0.90	0.90	0.73	0.29	0.61	1.43	1.43	1.16	0.47
S	3.01	0.78	0.78	1.52	1.29	4.41	1.20	1.20	2.27	1.85
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-139 Experiment 5 % wt of Element and % Atomic of No. 3 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.44/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.38	2.25	1.53	2.05	0.46	9.43	9.52	6.64	8.53	1.64
O	2.07	0.00	0.00	0.69	1.20	6.17	0.00	0.00	2.06	3.56
Al	0.46	0.15	0.29	0.30	0.16	0.82	0.15	0.30	0.42	0.35
Si	1.06	0.34	0.61	0.67	0.36	1.79	0.27	0.50	0.85	0.82
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	91.38	94.95	86.26	90.86	4.37	78.01	95.76	89.14	87.64	8.97
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.74	0.15	0.18	0.36	0.33	0.88	0.15	0.19	0.41	0.41
Ti	0.00	0.00	v	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.42	0.33	0.25	0.22	0.00	0.37	0.31	0.23	0.20
P	1.00	1.00	1.65	1.22	0.38	1.54	0.99	1.66	1.40	0.36
S	0.91	0.73	1.16	0.93	0.22	1.36	0.77	1.25	1.13	0.31
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-140 Experiment 5 % wt of Element and % Atomic of No. 3 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.44/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.66	1.86	1.92	2.15	0.45	9.85	7.70	7.55	8.37	1.29
O	4.93	1.19	3.18	3.10	1.87	13.70	3.72	9.38	8.93	5.00
Al	0.78	0.25	0.45	0.49	0.27	1.29	0.47	0.78	0.85	0.41
Si	1.45	0.53	1.04	1.01	0.46	2.30	0.94	1.75	1.66	0.68
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	86.24	93.61	90.47	90.11	3.70	68.57	83.52	76.41	76.17	7.48
Zr	1.00	0.00	0.00	0.33	0.58	0.49	0.00	0.00	0.16	0.28
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	1.01	0.38	0.77	0.72	0.32	1.12	0.47	0.91	0.83	0.33
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.02	0.34	0.00	0.12	0.19	0.01	0.27	0.00	0.09	0.15
P	0.00	0.98	0.53	0.50	0.49	0.00	1.58	0.81	0.80	0.79
S	1.74	0.86	1.63	1.41	0.48	2.41	1.33	2.40	2.05	0.62
Mg	0.14	0.00	0.00	0.05	0.08	0.26	0.00	0.00	0.09	0.15
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-141 Experiment 5 % wt of Element and % Atomic of No. 4 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.24	1.95	2.18	2.12	0.15	9.09	7.99	8.73	8.60	0.56
O	1.62	1.67	2.54	1.94	0.52	4.94	5.14	7.64	5.91	1.50
Al	0.29	0.24	0.24	0.26	0.03	0.52	0.44	0.43	0.46	0.05
Si	0.67	0.64	0.62	0.64	0.03	1.16	1.11	1.07	1.11	0.05
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	93.23	93.54	93.04	93.27	0.25	81.46	82.46	80.06	81.33	1.21
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.17	0.14	0.00	0.10	0.09	0.21	0.18	0.00	0.13	0.11
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.18	0.22	0.00	0.13	0.12	0.13	0.17	0.00	0.10	0.09
P	0.85	0.86	0.59	0.77	0.15	1.33	1.37	0.91	1.20	0.25
S	0.76	0.75	0.78	0.76	0.02	1.15	1.15	1.17	1.16	0.01
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-142 Experiment 5 % wt of Element and % Atomic of No. 4 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	1.89	2.19	1.71	1.93	0.24	8.06	9.27	7.37	8.23	0.96
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Si	0.24	0.00	0.00	0.08	0.14	0.43	0.00	0.00	0.14	0.25
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	95.17	94.88	95.70	95.25	0.42	87.46	86.50	88.84	87.60	1.18
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.46	0.62	0.58	0.55	0.08	0.37	0.50	0.47	0.45	0.07
P	1.30	1.25	1.17	1.24	0.07	2.16	2.05	1.96	2.06	0.10
S	0.95	1.06	0.84	0.95	0.11	1.52	1.68	1.36	1.52	0.16
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-143 Experiment 5 % wt of Element and % Atomic of No. 4 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.82	1.73	2.20	2.25	0.55	11.06	7.12	9.00	9.06	1.97
O	1.91	1.58	1.28	1.59	0.32	5.61	4.87	3.95	4.81	0.83
Al	0.44	0.41	0.27	0.37	0.09	0.77	0.76	0.49	0.67	0.16
Si	1.02	0.98	0.62	0.87	0.22	1.71	1.72	1.09	1.51	0.36
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	90.72	93.31	93.42	92.48	1.53	76.58	82.52	82.27	80.46	3.36
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.37	0.33	0.21	0.30	0.08	0.43	0.40	0.26	0.36	0.09
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.56	0.07	0.22	0.28	0.25	0.41	0.06	0.17	0.21	0.18
P	1.03	0.81	0.96	0.93	0.11	1.56	1.29	1.52	1.46	0.15
S	0.83	0.68	0.82	0.78	0.08	1.22	1.05	1.26	1.18	0.11
Mg	0.13	0.11	0.00	0.08	0.07	0.25	0.22	0.00	0.16	0.14
Na	0.20	0.00	0.00	0.07	0.12	0.40	0.00	0.00	0.13	0.23
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-144 Experiment 5 % wt of Element and % Atomic of No. 5 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.63/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.63	2.40	1.95	2.33	0.35	10.46	10.01	7.33	9.27	1.69
O	1.90	0.00	6.14	2.68	3.14	5.69	0.00	17.33	7.67	8.83
Al	0.30	0.21	0.10	0.20	0.10	0.54	0.39	0.17	0.37	0.19
Si	0.61	0.51	0.32	0.48	0.15	1.04	0.91	0.51	0.82	0.28
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	91.88	93.98	90.32	92.06	1.84	78.64	84.43	73.00	78.69	5.72
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.29	0.18	0.00	0.16	0.15	0.35	0.23	0.00	0.19	0.18
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.45	0.40	0.00	0.28	0.25	0.34	0.31	0.00	0.22	0.19
P	1.12	1.34	0.35	0.94	0.52	1.72	2.17	0.51	1.47	0.86
S	0.82	0.99	0.82	0.88	0.10	1.22	1.55	1.15	1.31	0.21
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-145 Experiment 5 % wt of Element and % Atomic of No. 5 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.63/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.71	2.06	2.38	2.38	0.33	11.23	8.28	9.60	9.70	1.48
O	0.16	1.97	1.63	1.25	0.96	0.11	5.94	4.92	3.66	3.11
Al	0.18	0.42	0.32	0.31	0.12	0.33	0.75	0.57	0.55	0.21
Si	0.46	1.04	0.79	0.76	0.29	0.81	1.79	1.35	1.32	0.49
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	93.76	91.93	92.31	92.67	0.97	83.61	79.58	79.88	81.02	2.25
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.13	0.43	0.29	0.28	0.15	0.17	0.52	0.34	0.34	0.18
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.46	0.22	0.24	0.31	0.13	0.36	0.16	0.18	0.23	0.11
P	1.20	1.12	1.12	1.15	0.05	1.93	1.75	1.74	1.81	0.11
S	0.93	0.81	0.93	0.89	0.07	1.45	1.23	1.41	1.36	0.12
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-146 Experiment 5 % wt of Element and % Atomic of No. 5 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.63/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	1.31	1.55	1.75	1.54	0.22	5.50	6.55	7.21	6.42	0.86
O	1.39	1.01	1.71	1.37	0.35	4.39	3.19	5.28	4.29	1.05
Al	0.34	0.25	0.46	0.35	0.11	0.63	0.47	0.85	0.65	0.19
Si	0.93	0.52	0.92	0.79	0.23	1.66	0.93	1.62	1.40	0.41
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.21	94.94	93.43	94.19	0.76	84.96	86.12	82.61	84.56	1.79
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.30	0.18	0.82	0.43	0.34	0.38	0.23	1.01	0.54	0.41
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.84	0.92	0.44	0.73	0.26	1.37	1.50	0.71	1.19	0.42
S	0.59	0.64	0.45	0.56	0.10	0.93	1.01	0.69	0.88	0.17
Mg	0.09	0.00	0.00	0.03	0.05	0.19	0.00	0.00	0.06	0.11
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-147 Experiment 5 % wt of Element and % Atomic of No. 6 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.72/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.81	2.44	3.58	2.94	0.58	11.65	10.23	13.95	11.94	1.88
O	0.00	0.00	1.60	0.53	0.92	0.00	0.00	4.66	1.55	2.69
Al	0.25	0.14	0.30	0.23	0.08	0.45	0.25	0.52	0.41	0.14
Si	0.55	0.23	0.65	0.48	0.22	0.97	0.41	1.08	0.82	0.36
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.23	95.31	91.52	93.69	1.95	83.91	86.12	76.62	82.22	4.97
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.29	0.17	0.30	0.25	0.07	0.36	0.22	0.35	0.31	0.08
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.37	0.00	0.30	0.22	0.20	0.29	0.00	0.22	0.17	0.15
P	0.82	0.96	0.95	0.91	0.08	1.32	1.56	1.44	1.44	0.12
S	0.67	0.76	0.79	0.74	0.06	1.04	1.20	1.16	1.13	0.08
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-148 Experiment 5 % wt of Element and % Atomic of No. 6 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.72/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.49	2.44	3.20	2.71	0.43	10.44	10.31	12.60	11.12	1.29
O	0.00	0.00	1.55	0.52	0.89	0.00	0.00	4.59	1.53	2.65
Al	0.00	0.00	0.37	0.12	0.21	0.00	0.00	0.64	0.21	0.37
Si	0.22	0.00	0.64	0.29	0.33	0.40	0.00	1.08	0.49	0.55
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.77	96.14	91.93	94.28	2.15	85.46	87.40	77.92	83.59	5.01
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.12	0.00	0.50	0.21	0.26	0.16	0.00	0.59	0.25	0.31
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0 00	-
Cu	0.37	0.00	0.20	0.19	0.19	0.29	0.00	0.15	0.15	0.15
P	1.21	0.81	0.83	0.95	0.23	1.97	1.32	1.26	1.52	0.39
S	0.82	0.61	0.78	0.74	0.11	1.28	0.97	1.16	1.14	0.16
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0 00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0 00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-149 Experiment 5 % wt of Element and % Atomic of No. 6 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.72/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.69	2.88	2.40	2.66	0.24	11.21	11.57	9.83	10.87	0.92
O	0.00	1.14	1.12	0.75	0.65	0.00	3.44	3.44	2.29	1.99
Al	0.23	0.30	0.27	0.27	0.04	0.42	0.54	0.48	0.48	0.06
Si	0.45	0.45	0.40	0.43	0.03	0.81	0.78	0.70	0.76	0.06
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.48	93.26	93.95	93.90	0.61	84.57	80.72	82.70	82.66	1.93
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.29	0.25	0.19	0.24	0.05	0.36	0.30	0.23	0.30	0.07
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.40	0.00	0.00	0.13	0.23	0.31	0.00	0.00	0.10	0.18
P	0.83	0.95	1.04	0.94	0.11	1.33	1.48	1.65	1.49	0.16
S	0.64	0.78	0.63	0.68	0.08	0.99	1.18	0.97	1.05	0.12
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-150 Experiment 5 % wt of Element and % Atomic of No. 7 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.82/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.57	2.26	2.21	2.35	0.20	10.37	9.59	9.35	9.77	0.53
O	1.62	0.00	0.00	0.54	0.94	4.92	0.00	0.00	1.64	2.84
Al	0.10	0.00	0.08	0.06	0.05	0.18	0.00	0.16	0.11	0.10
Si	0.28	0.20	0.23	0.24	0.04	0.48	0.36	0.41	0.42	0.06
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	93.50	95.48	95.24	94.74	1.08	81.29	87.00	86.73	85.01	3.22
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.12	0.00	0.00	0.04	0.07	0.15	0.00	0.00	0.05	0.09
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.23	0.35	0.35	0.31	0.07	0.18	0.28	0.28	0.25	0.06
P	0.93	1.02	1.19	1.05	0.13	1.46	1.67	1.95	1.69	0.25
S	0.65	0.69	0.70	0.68	0.03	0.99	1.09	1.11	1.06	0.06
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-151 Experiment 5 % wt of Element and % Atomic of No. 7 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.82/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.50	2.19	2.15	2.28	0.19	9.99	8.78	8.77	9.18	0.70
O	1.81	1.92	1.53	1.75	0.20	5.41	5.78	4.68	5.29	0.56
Al	0.40	0.50	0.32	0.41	0.09	0.72	0.90	0.57	0.73	0.17
Si	0.89	1.05	0.71	0.88	0.17	1.52	1.80	1.23	1.52	0.29
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	91.93	91.72	93.34	92.33	0.88	78.89	79.08	81.82	79.93	1.64
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.45	0.70	0.40	0.52	0.16	0.54	0.84	0.48	0.62	0.19
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.18	0.15	0.00	0.11	0.10	0.14	0.12	0.00	0.09	0.08
P	1.10	1.03	0.93	1.02	0.09	1.70	1.60	1.47	1.59	0.12
S	0.73	0.74	0.63	0.70	0.06	1.09	1.12	0.96	1.06	0.09
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-152 Experiment 5 % wt of Element and % Atomic of No. 7 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.82/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.10	1.80	2.44	2.11	0.32	8.95	7.77	10.27	9.00	1.25
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.08	0.00	0.00	0.03	0.05	0.16	0.00	0.00	0.05	0.09
Si	0.18	0.13	0.91	0.41	0.44	0.32	0.24	1.49	0.68	0.70
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	96.04	96.42	95.83	96.10	0.30	87.97	89.28	86.94	88.06	1.17
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.86	0.96	0.82	0.88	0.07	1.42	1.60	1.30	1.44	0.15
S	0.74	0.69	0.00	0.48	0.41	1.18	1.11	0.00	0.76	0.66
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-153 Experiment 5 % wt of Element and % Atomic of No. 8 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.91/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	1.57	1.15	1.48	1.40	0.22	6.69	5.05	6.20	5.98	0.84
O	0.00	0.00	1.02	0.34	0.59	0.00	0.00	3.23	1.08	1.86
Al	0.25	0.00	0.00	0.08	0.14	0.48	0.00	0.00	0.16	0.28
Si	0.25	0.17	0.43	0.28	0.13	0.46	0.31	0.77	0.51	0.23
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.06	95.42	93.20	94.23	1.12	86.47	89.70	84.14	86.77	2.79
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.13	0.00	0.00	0.04	0.08	0.16	0.00	0.00	0.05	0.09
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.46	0.31	0.29	0.35	0.09	0.38	0.25	0.23	0.29	0.08
P	2.14	1.77	2.01	1.97	0.19	3.55	3.01	3.27	3.28	0.27
S	1.13	0.93	1.24	1.10	0.16	1.81	1.52	1.95	1.76	0.22
Mg	0.00	0.25	0.33	0.19	0.17	0.00	0.17	0.21	0.13	0.11
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-154 Experiment 5 % wt of Element and % Atomic of No. 8 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.91/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	1.47	1.50	2.68	1.88	0.69	6.27	6.41	11.06	7.91	2.73
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.19	0.12	0.17	0.16	0.04	0.36	0.23	0.32	0.30	0.07
Si	0.46	0.19	0.27	0.31	0.14	0.84	0.35	0.47	0.55	0.26
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	93.27	93.87	93.27	93.47	0.35	85.55	86.51	82.86	84.97	1.89
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.18	0.00	0.00	0.06	0.10	0.22	0.00	0.00	0.07	0.13
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.58	0.70	0.52	0.60	0.09	0.46	0.57	0.41	0.48	0.08
P	2.38	2.23	1.89	2.17	0.25	3.93	3.70	3.02	3.55	0.47
S	1.48	1.39	1.21	1.36	0.14	2.36	2.24	1.87	2.16	0.26
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-155 Experiment 5 % wt of Element and % Atomic of No. 8 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.91/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	1.29	1.25	1.85	1.46	0.34	5.26	5.10	7.87	6.08	1.56
O	2.03	2.55	0.00	1.53	1.35	6.23	7.79	0.00	4.67	4.12
Al	0.33	0.21	0.13	0.22	0.10	0.59	0.38	0.26	0.41	0.17
Si	0.87	0.57	0.30	0.58	0.29	1.52	0.98	0.55	1.02	0.49
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	91.29	91.82	94.86	92.66	1.93	80.25	80.25	86.70	82.40	3.72
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.37	0.23	0.00	0.20	0.19	0.46	0.27	0.00	0.24	0.23
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.36	0.00	0.00	0.12	0.21	0.28	0.00	0.00	0.09	0.16
P	2.00	1.69	1.59	1.76	0.21	3.17	2.67	2.61	2.82	0.31
S	1.47	1.67	1.27	1.47	0.20	2.25	2.55	2.02	2.27	0.27
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-156 Experiment 5 % wt of Element and % Atomic of No. 3 Slag (1425°C, 20 min, mole ratio C/Fe = 1.44/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	7.76	6.08	0.00	4.61	4.08	15.36	12.05	0.00	9.14	8.08
O	28.43	31.23	28.01	29.22	1.75	42.26	46.45	46.48	45.06	2.43
Al	6.23	6.25	6.82	6.43	0.34	5.49	5.51	6.71	5.90	0.70
Si	14.52	14.50	16.28	15.10	1.02	12.30	12.28	15.39	13.32	1.79
K	1.33	1.26	1.40	1.33	0.07	0.81	0.76	0.95	0.84	0.10
Fe	5.12	4.88	5.47	5.16	0.30	2.18	2.08	2.60	2.29	0.28
Zr	1.16	1.42	0.00	0.86	0.76	0.30	0.37	0.00	0.22	0.20
Mn	0.00	0.50	0.66	0.39	0.34	0.00	0.22	0.32	0.18	0.16
Ca	33.93	32.60	40.10	35.54	4.00	20.14	19.36	26.56	22.02	3.95
Ti	0.56	0.56	0.57	0.56	0.01	0.28	0.28	0.31	0.29	0.02
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.28	0.32	0.26	0.29	0.03	0.21	0.23	0.22	0.22	0.01
Mg	0.45	0.41	0.42	0.43	0.02	0.44	0.40	0.46	0.43	0.03
Na	0.23	0.00	0.00	0.08	0.13	0.23	0.00	0.00	0.08	0.13
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-157 Experiment 5 % wt of Element and % Atomic of No. Slag (1425°C, 20 min, mole ratio C/Fe = 1.44/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	6.95	0.00	0.00	2.32	4.01	13.15	0.00	0.00	4.38	7.59
O	36.74	35.96	30.97	34.56	3.13	52.22	57.33	50.22	53.26	3.67
Al	5.62	5.03	6.80	5.82	0.90	4.74	4.76	6.53	5.34	1.03
Si	12.48	11.36	15.52	13.12	2.15	10.10	10.31	14.33	11.58	2.38
K	1.17	1.30	1.36	1.28	0.10	0.68	0.85	0.90	0.81	0.12
Fe	10.48	17.42	4.85	10.92	6.30	4.27	7.96	2.25	4.83	2.90
Zr	1.54	0.00	1.22	0.92	0.81	0.38		0.35	0.37	0.02
Mn	0.00	0.00	0.62	0.21	0.36	0.00	0.00	0.29	0.10	0.17
Ca	23.56	26.12	37.78	29.15	7.58	13.37	16.62	24.46	18.15	5.70
Ti	0.38	0.42	0.53	0.44	0.08	0.18	0.23	0.29	0.23	0.06
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	1.62	0.00	0.54	0.94	0.00	1.33	0.00	0.44	0.77
S	0.51	0.78	0.00	0.43	0.40	0.36	0.62	0.00	0.33	0.31
Mg	0.34	0.00	0.35	0.23	0.20	0.32	0.00	0.37	0.23	0.20
Na	0.23	0.00	0.00	0.08	0.13	0.23	0.00	0.00	0.08	0.13
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-158 Experiment 5 % wt of Element and % Atomic of No. Slag (1425°C, 20 min, mole ratio C/Fe = 1.44/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	32.40	33.57	25.86	30.61	4.16	51.02	52.29	43.56	48.96	4.72
Al	7.41	7.20	6.59	7.07	0.43	6.92	6.65	6.58	6.72	0.18
Si	17.40	16.94	16.27	16.87	0.57	15.61	15.04	15.61	15.42	0.33
K	1.37	1.31	1.70	1.46	0.21	0.88	0.83	1.17	0.96	0.18
Fe	1.43	2.41	2.25	2.03	0.53	0.65	1.08	1.09	0.94	0.25
Zr	1.11	0.00	0.00	0.37	0.64	0.31	0.00	0.00	0.10	0.18
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	37.54	37.50	45.88	40.31	4.83	23.60	23.32	30.86	25.93	4.27
Ti	0.56	0.62	0.69	0.62	0.07	0.30	0.32	0.39	0.34	0.05
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.37	0.00	0.37	0.25	0.21	0.29	0.00	0.31	0.20	0.17
Mg	0.42	0.45	0.39	0.42	0.03	0.43	0.46	0.43	0.44	0.02
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-159 Experiment 5 % wt of Element and % Atomic of No. 4 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	31.97	31.74	32.01	31.91	0.15	50.15	50.07	50.27	50.16	0.10
Al	7.66	7.46	7.64	7.59	0.11	7.12	6.98	7.12	7.07	0.08
Si	17.99	17.40	17.73	17.71	0.30	16.07	15.63	15.86	15.85	0.22
K	1.22	1.26	1.18	1.22	0.04	0.78	0.81	0.76	0.78	0.03
Fe	1.06	1.81	1.10	1.32	0.42	0.48	0.82	0.50	0.60	0.19
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	38.52	38.63	38.96	38.70	0.23	24.11	24.32	24.42	24.28	0.16
Ti	0.52	0.58	0.50	0.53	0.04	0.27	0.30	0.26	0.28	0.02
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.37	0.48	0.36	0.40	0.07	0.29	0.38	0.28	0.32	0.06
Mg	0.42	0.46	0.51	0.46	0.05	0.44	0.47	0.53	0.48	0.05
Na	0.26	0.20	0.00	0.15	0.14	0.29	0.22	0.00	0.17	0.15
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-160 Experiment 5 % wt of Element and % Atomic of No. 4 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	23.99	32.46	30.10	28.85	4.37	41.31	50.87	48.35	46.84	4.95
Al	6.30	7.42	7.05	6.92	0.57	6.43	6.89	6.71	6.68	0.23
Si	15.41	17.22	16.81	16.48	0.95	15.11	15.37	15.39	15.29	0.16
K	1.32	1.07	1.21	1.20	0.13	0.93	0.69	0.79	0.80	0.12
Fe	1.84	0.82	1.02	1.23	0.54	0.91	0.37	0.47	0.58	0.29
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	49.82	39.59	42.18	43.86	5.32	34.24	24.76	27.04	28.68	4.95
Ti	0.60	0.66	0.65	0.64	0.03	0.34	0.35	0.35	0.35	0.01
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.37	0.34	0.55	0.42	0.11	0.32	0.27	0.44	0.34	0.09
Mg	0.36	0.42	0.43	0.40	0.04	0.41	0.43	0.45	0.43	0.02
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-161 Experiment 5 % wt of Element and % Atomic of No. 4 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	8.08	2.69	4.66	0.00	0.00	15.55	5.18	8.98
O	26.25	26.52	31.51	28.09	2.96	44.19	45.18	45.51	44.96	0.69
Al	6.79	6.09	5.80	6.23	0.51	6.77	6.15	4.97	5.96	0.91
Si	16.18	14.14	12.06	14.13	2.06	15.51	13.72	9.92	13.05	2.85
K	1.36	1.35	0.00	0.90	0.78	0.94	0.94	0.00	0.63	0.54
Fe	1.94	3.90	3.63	3.16	1.06	0.93	1.90	1.50	1.44	0.49
Zr	1.14	1.80	0.00	0.98	0.91	0.34	0.54	0.00	0.29	0.27
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	45.02	44.66	37.47	42.38	4.26	30.25	30.37	21.60	27.41	5.03
Ti	0.63	0.75	0.89	0.76	0.13	0.35	0.43	0.43	0.40	0.05
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.24	0.42	0.00	0.22	0.21	0.20	0.36	0.00	0.19	0.18
Mg	0.46	0.37	0.56	0.46	0.10	0.51	0.41	0.53	0.48	0.06
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-162 Experiment 5 % wt of Element and % Atomic of No. 5 Slag (1425°C, 20 min, mole ratio C/Fe = 1.63/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	3.68	4.50	0.94	3.04	1.86	7.20	8.71	1.94	5.95	3.55
O	34.67	34.47	31.78	33.64	1.61	50.99	50.10	49.46	50.18	0.77
Al	7.15	7.18	7.49	7.27	0.19	6.24	6.19	6.91	6.45	0.40
Si	16.62	16.61	17.78	17.00	0.67	13.92	13.75	15.77	14.48	1.12
K	1.19	1.12	1.29	1.20	0.09	0.71	0.67	0.82	0.73	0.08
Fe	2.98	2.19	2.71	2.63	0.40	1.26	0.91	1.21	1.13	0.19
Zr	0.95	0.96	0.00	0.64	0.55	0.25	0.24	0.00	0.16	0.14
Mn	0.38	0.00	0.00	0.13	0.22	0.16	0.00	0.00	0.05	0.09
Ca	30.92	31.33	36.42	32.89	3.06	18.15	18.18	22.62	19.65	2.57
Ti	0.49	0.54	0.58	0.54	0.05	0.24	0.26	0.30	0.27	0.03
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.27	0.32	0.28	0.29	0.03	0.20	0.23	0.22	0.22	0.02
Mg	0.46	0.50	0.49	0.48	0.02	0.44	0.48	0.50	0.47	0.03
Na	0.23	0.27	0.23	0.24	0.02	0.24	0.28	0.25	0.26	0.02
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-163 Experiment 5 % wt of Element and % Atomic of No. 5 Slag (1425°C, 20 min, mole ratio C/Fe = 1.63/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	7.06	4.70	12.15	7.97	3.81	12.69	9.18	26.17	16.01	8.97
O	40.50	34.12	15.81	30.14	12.82	54.64	49.97	25.56	43.39	15.62
Al	6.30	6.67	5.05	6.01	0.85	5.04	5.79	4.84	5.22	0.50
Si	14.24	15.55	9.53	13.11	3.17	10.95	12.98	8.78	10.90	2.10
K	0.93	1.26	1.33	1.17	0.21	0.51	0.76	0.88	0.72	0.19
Fe	2.02	3.87	7.17	4.35	2.61	0.78	1.62	3.32	1.91	1.29
Zr	1.39	1.04	2.48	1.64	0.75	0.33	0.27	0.70	0.43	0.23
Mn	0.36		1.04	0.70	0.48	0.14		0.49	0.32	0.25
Ca	25.85	31.53	44.83	34.07	9.74	13.92	18.43	28.93	20.43	7.70
Ti	0.38	0.47	0.60	0.48	0.11	0.17	0.23	0.32	0.24	0.08
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.23	0.00	0.00	0.08	0.13	0.16	0.00	0.00	0.05	0.09
Mg	0.39	0.51	0.00	0.30	0.27	0.35	0.49	0.00	0.28	0.25
Na	0.35	0.28	0.00	0.21	0.19	0.33	0.29	0.00	0.21	0.18
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-164 Experiment 5 % wt of Element and % Atomic of No. 5 Slag (1425°C, 20 min, mole ratio C/Fe = 1.63/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	9.33	7.52	0.00	5.62	4.95	18.14	14.75	0.00	10.96	9.64
O	27.58	29.04	32.54	29.72	2.55	40.27	42.75	51.05	44.69	5.65
Al	6.35	6.61	7.39	6.78	0.54	5.50	5.77	6.87	6.05	0.73
Si	15.13	15.90	17.88	16.30	1.42	12.58	13.34	15.98	13.97	1.78
K	1.35	1.37	1.37	1.36	0.01	0.81	0.83	0.88	0.84	0.04
Fe	3.65	3.43	3.24	3.44	0.21	1.53	1.45	1.46	1.48	0.04
Zr	0.98	0.89	0.00	0.62	0.54	0.25	0.23	0.00	0.16	0.14
Mn	0.44	0.45	0.00	0.30	0.26	0.19	0.19	0.00	0.13	0.11
Ca	33.76	33.35	36.19	34.43	1.54	19.67	19.60	22.67	20.65	1.75
Ti	0.54	0.54	0.55	0.54	0.01	0.26	0.26	0.29	0.27	0.02
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.22	0.28	0.28	0.26	0.03	0.16	0.20	0.22	0.19	0.03
Mg	0.44	0.38	0.56	0.46	0.09	0.42	0.37	0.58	0.46	0.11
Na	0.22	0.25	0.00	0.16	0.14	0.22	0.25	0.00	0.16	0.14
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-165 Experiment 5 % wt of Element and % Atomic of No. 6 Slag (1425°C, 20 min, mole ratio C/Fe = 1.72/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	22.96	31.66	36.43	30.35	6.83	40.94	50.42	55.22	48.86	7.27
Al	6.17	7.44	7.89	7.17	0.89	6.52	7.03	7.09	6.88	0.31
Si	14.26	17.76	17.98	16.67	2.09	14.49	16.11	15.52	15.37	0.82
K	1.81	1.40	1.51	1.57	0.21	1.32	0.91	0.94	1.06	0.23
Fe	10.52	6.57	5.41	7.50	2.68	5.37	3.00	2.35	3.57	1.59
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	1.05	0.56	0.45	0.69	0.32	0.55	0.26	0.20	0.34	0.19
Ca	42.00	33.24	29.01	34.75	6.63	29.89	21.13	17.56	22.86	6.34
Ti	0.92	0.61	0.43	0.65	0.25	0.55	0.33	0.22	0.37	0.17
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.32	0.47	0.53	0.44	0.11	0.38	0.50	0.52	0.47	0.08
Na	0.00	0.29	0.37	0.22	0.19	0.00	0.32	0.39	0.24	0.21
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-166 Experiment 5 % wt of Element and % Atomic of No. 6 Slag (1425°C, 20 min, mole ratio C/Fe = 1.72/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	25.70	19.12	25.29	23.37	3.69	43.97	35.86	43.46	41.10	4.54
Al	6.32	5.37	6.65	6.11	0.66	6.41	5.97	6.77	6.38	0.40
Si	15.81	13.18	15.84	14.94	1.53	15.41	14.09	15.51	15.00	0.79
K	1.79	2.00	1.81	1.87	0.12	1.26	1.53	1.27	1.35	0.15
Fe	8.03	11.37	9.10	9.50	1.71	3.93	6.11	4.48	4.84	1.13
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	1.15	0.65	0.60	0.58	0.00	0.63	0.32	0.32	0.32
Ca	41.24	46.62	39.19	42.35	3.84	28.16	34.91	26.89	29.99	4.31
Ti	0.71	0.93	0.57	0.74	0.18	0.40	0.58	0.33	0.44	0.13
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.00	0.29	0.10	0.17	0.00	0.00	0.25	0.08	0.14
Mg	0.40	0.26	0.37	0.34	0.07	0.45	0.33	0.42	0.40	0.06
Na	0.00	0.00	0.25	0.08	0.14	0.00	0.00	0.30	0.10	0.17
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-167 Experiment 5 % wt of Element and % Atomic of No. 6 Slag (1425°C, 20 min, mole ratio C/Fe = 1.72/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	31.57	32.57	27.89	30.68	2.46	50.08	51.15	46.11	49.11	2.66
Al	0.52	7.67	7.36	5.18	4.04	0.54	7.14	7.22	4.97	3.83
Si	7.87	18.03	17.64	14.51	5.76	7.40	16.13	16.61	13.38	5.18
K	1.49	1.58	1.79	1.62	0.15	0.97	1.01	1.21	1.06	0.13
Fe	5.91	4.58	5.98	5.49	0.79	2.69	2.06	2.83	2.53	0.41
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.68	0.23	0.39	0.00	0.00	0.33	0.11	0.19
Ca	33.47	34.18	37.12	34.92	1.94	21.19	21.43	24.49	22.37	1.84
Ti	0.65	0.54	0.71	0.63	0.09	0.34	0.28	0.39	0.34	0.06
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	18.26	0.34	0.33	6.31	10.35	16.50	0.26	0.27	5.68	9.37
Mg	0.00	0.51	0.49	0.33	0.29	0.00	0.52	0.54	0.35	0.31
Na	0.26	0.00	0.00	0.09	0.15	0.29	0.00	0.00	0.10	0.17
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-168 Experiment 5 % wt of Element and % Atomic of No. 7 Slag (1425°C, 20 min, mole ratio C/Fe = 1.82/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	32.71	29.13	32.87	31.57	2.11	51.04	47.04	51.19	49.76	2.35
Al	7.83	7.43	7.64	7.63	0.20	7.25	7.12	7.05	7.14	0.10
Si	17.87	18.10	17.42	17.80	0.35	15.89	16.65	15.45	16.00	0.61
K	1.12	1.35	1.10	1.19	0.14	0.71	0.89	0.70	0.77	0.11
Fe	1.24	1.44	1.17	1.28	0.14	0.55	0.67	0.52	0.58	0.08
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.54	0.00	0.00	0.18	0.31	0.25	0.00	0.00	0.08	0.14
Ca	37.03	40.72	37.76	38.50	1.95	23.06	26.25	23.47	24.26	1.74
Ti	0.60	0.80	0.64	0.68	0.11	0.31	0.43	0.33	0.36	0.06
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.59	0.54	0.66	0.60	0.06	0.46	0.44	0.51	0.47	0.04
Mg	0.46	0.49	0.49	0.48	0.02	0.48	0.52	0.51	0.50	0.02
Na	0.00	0.00	0.25	0.08	0.14	0.00	0.00	0.27	0.09	0.16
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-169 Experiment 5 % wt of Element and % Atomic of No. 7 Slag (1425°C, 20 min, mole ratio C/Fe = 1.82/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	21.24	0.00	0.00	7.08	12.26	38.19	0.00	0.00	12.73	22.05
O	20.21	29.65	28.32	26.06	5.11	27.27	48.03	46.79	40.70	11.64
Al	4.55	6.91	6.82	6.09	1.34	3.64	6.64	6.68	5.65	1.74
Si	10.30	15.73	15.31	13.78	3.02	7.92	14.52	14.41	12.28	3.78
K	0.90	1.17	1.13	1.07	0.15	0.50	0.78	0.76	0.68	0.16
Fe	1.98	1.69	1.77	1.81	0.15	0.76	0.78	0.84	0.79	0.04
Zr	1.33	0.00	1.37	0.90	0.78	0.31	0.00	0.40	0.24	0.21
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	37.97	42.97	43.34	41.43	3.00	20.45	27.78	28.59	25.61	4.48
Ti	0.61	0.61	0.67	0.63	0.03	0.27	0.33	0.37	0.32	0.05
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.66	0.82	0.82	0.77	0.09	0.45	0.66	0.68	0.60	0.13
Mg	0.26	0.44	0.45	0.38	0.11	0.23	0.47	0.49	0.40	0.14
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-170 Experiment 5 % wt of Element and % Atomic of No. 7 Slag (1425°C, 20 min, mole ratio C/Fe = 1.82/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	32.09	31.43	33.52	32.35	1.07	50.43	49.56	52.13	50.71	1.31
Al	7.39	7.73	7.11	7.41	0.31	6.89	7.23	6.56	6.89	0.34
Si	17.84	17.74	16.97	17.52	0.48	15.97	15.93	15.03	15.64	0.53
K	1.13	1.10	1.01	1.08	0.06	0.73	0.71	0.64	0.69	0.05
Fe	2.68	1.25	3.25	2.39	1.03	1.21	0.57	1.45	1.08	0.45
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.59	0.00	0.00	0.20	0.34	0.27	0.00	0.00	0.09	0.16
Ca	35.05	38.73	34.84	36.21	2.19	21.99	24.37	21.63	22.66	1.49
Ti	0.49	0.60	0.46	0.52	0.07	0.26	0.32	0.24	0.27	0.04
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	2.29	0.69	2.37	1.78	0.95	1.79	0.54	1.84	1.39	0.74
Mg	0.45	0.46	0.47	0.46	0.01	0.47	0.47	0.49	0.48	0.01
Na	0.00	0.27	0.00	0.09	0.16	0.00	0.29	0.00	0.10	0.17
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-171 Experiment 5 % wt of Element and % Atomic of No. 8 Slag (1425°C, 20 min, mole ratio C/Fe = 1.91/1) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	40.46	28.07	31.06	33.20	6.47	58.95	46.00	49.54	51.50	6.69
Al	7.42	7.07	7.29	7.26	0.18	6.41	6.87	6.90	6.73	0.27
Si	16.76	17.04	16.16	16.65	0.45	13.91	15.90	14.68	14.83	1.00
K	0.76	1.06	0.99	0.94	0.16	0.45	0.71	0.65	0.60	0.14
Fe	0.79	1.19	1.38	1.12	0.30	0.33	0.56	0.63	0.51	0.16
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.44	0.00	0.00	0.15	0.25	0.19	0.00	0.00	0.06	0.11
Ca	31.58	43.89	41.81	39.09	6.59	18.37	28.71	26.62	24.57	5.47
Ti	0.51	0.78	0.54	0.61	0.15	0.25	0.43	0.29	0.32	0.09
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.44	0.58	0.39	0.47	0.10	0.32	0.47	0.31	0.37	0.09
Mg	0.46	0.32	0.37	0.38	0.07	0.44	0.34	0.39	0.39	0.05
Na	0.38	0.00	0.00	0.13	0.22	0.38	0.00	0.00	0.13	0.22
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-172 Experiment 5 % wt of Element and % Atomic of No. 8 Slag (1425°C, 20 min, mole ratio C/Fe = 1.91/1) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	36.61	34.87	33.57	35.02	1.53	54.86	53.30	51.89	53.35	1.49
Al	8.06	7.79	7.72	7.86	0.18	7.16	7.06	7.07	7.10	0.06
Si	18.27	18.02	17.51	17.93	0.39	15.59	15.69	15.42	15.57	0.14
K	0.77	0.80	0.84	0.80	0.04	0.47	0.50	0.53	0.50	0.03
Fe	0.78	2.31	1.04	1.38	0.82	0.33	1.01	0.46	0.60	0.36
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	33.73	34.28	37.56	35.19	2.07	20.18	20.92	23.18	21.43	1.56
Ti	0.56	0.62	0.49	0.56	0.07	0.28	0.32	0.26	0.29	0.03
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.40	0.54	0.51	0.48	0.07	0.30	0.41	0.39	0.37	0.06
Mg	0.54	0.49	0.47	0.50	0.04	0.54	0.49	0.48	0.50	0.03
Na	0.28	0.29	0.29	0.29	0.01	0.29	0.30	0.31	0.30	0.01
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

Table E-173 Experiment 5 % wt of Element and % Atomic of No. 8 Slag (1425°C, 20 min, mole ratio C/Fe = 1.91/1) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	29.76	31.85	28.23	29.95	1.82	47.72	50.03	46.08	47.94	1.98
Al	7.42	7.82	7.53	7.59	0.21	7.05	7.28	7.29	7.21	0.14
Si	18.12	17.98	17.16	17.75	0.52	16.55	16.09	15.96	16.20	0.31
K	0.79	0.85	1.03	0.89	0.12	0.52	0.55	0.69	0.59	0.09
Fe	0.88	1.14	1.24	1.09	0.19	0.40	0.51	0.58	0.50	0.09
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	41.33	38.70	43.15	41.06	2.24	26.46	24.27	28.12	26.28	1.93
Ti	0.70	0.62	0.66	0.66	0.04	0.38	0.33	0.36	0.36	0.03
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.52	0.51	0.56	0.53	0.03	0.42	0.40	0.45	0.42	0.03
Mg	0.48	0.53	0.44	0.48	0.05	0.51	0.55	0.47	0.51	0.04
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100	100	100	100	-	100	100	100	100	-

E.1.7 Experiment 6

Table E-174 Experiment 6 % wt of Element and % Atomic of No. 1 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.50) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	3.36	14.05	9.20	8.87	5.35	13.74	42.90	30.99	29.21	14.66
O	0.00	0.00	1.01	0.34	0.58	0.00	0.00	2.55	0.85	1.47
Al	0.30	0.00	0.26	0.19	0.16	0.54	0.00	0.39	0.31	0.28
Si	0.23	0.16	0.45	0.28	0.15	0.40	0.21	0.65	0.42	0.22
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	94.89	84.38	87.06	88.78	5.46	83.56	55.42	63.05	67.34	14.55
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.21	0.07	0.12	0.00	0.00	0.21	0.07	0.12
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.21	0.29	0.25	0.25	0.04	0.16	0.17	0.16	0.16	0.01
P	0.63	0.59	0.85	0.69	0.14	1.00	0.70	1.11	0.94	0.21
S	0.39	0.53	0.70	0.54	0.16	0.60	0.61	0.89	0.70	0.16
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-175 Experiment 6 % wt of Element and % Atomic of No. 1 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.50) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	3.86	10.23	12.79	8.96	4.60	14.66	34.36	40.26	29.76	13.41
O	2.09	0.00	0.00	0.70	1.21	5.96	0.00	0.00	1.99	3.44
Al	0.56	0.41	0.10	0.36	0.23	0.94	0.61	0.14	0.56	0.40
Si	1.27	0.00	0.11	0.46	0.70	2.06	0.00	0.15	0.74	1.15
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	90.14	88.49	85.68	88.10	2.26	73.62	63.91	57.99	65.17	7.89
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.25	0.00	0.00	0.08	0.14	0.28	0.00	0.00	0.09	0.16
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.43	0.00	0.19	0.21	0.22	0.31	0.00	0.11	0.14	0.16
P	0.56	0.41	0.63	0.53	0.11	0.83	0.54	0.77	0.71	0.15
S	0.60	0.46	0.49	0.52	0.07	0.85	0.58	0.58	0.67	0.16
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.25	0.00	0.00	0.08	0.14	0.50	0.00	0.00	0.17	0.29
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-176 Experiment 6 % wt of Element and % Atomic of No. 1 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.50) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	5.95	5.97	12.71	8.21	3.90	22.56	22.66	40.19	28.47	10.15
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Si	0.00	0.09	0.00	0.03	0.05	0.00	0.15	0.00	0.05	0.09
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	92.96	93.11	86.42	90.83	3.82	75.85	76.00	58.77	70.21	9.90
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P	0.54	0.41	0.39	0.45	0.08	0.79	0.60	0.48	0.62	0.16
S	0.56	0.42	0.47	0.48	0.07	0.80	0.59	0.56	0.65	0.13
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-177 Experiment 6 % wt of Element and % Atomic of No. 2 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.60) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	27.64	38.19	12.84	26.22	12.73	60.45	73.90	40.21	58.19	16.96
O	3.51	0.00	0.00	1.17	2.03	5.76	0.00	0.00	1.92	3.33
Al	2.06	0.00	0.00	0.69	1.19	2.00	0.00	0.00	0.67	1.15
Si	0.16	0.16	0.45	0.26	0.17	0.15	0.13	0.63	0.30	0.28
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	65.83	60.33	85.29	70.48	13.11	30.97	25.10	57.46	37.84	17.24
Zr	0.00	0.24	0.00	0.08	-	0.00	0.07	0.00	0.02	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.41	0.60	0.88	0.63	0.24	0.34	0.45	1.07	0.62	0.39
S	0.40	0.48	0.53	0.47	0.07	0.33	0.35	0.62	0.43	0.16
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-178 Experiment 6 % wt of Element and % Atomic of No. 2 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.60) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	23.16	20.88	41.81	28.62	11.48	57.76	54.78	76.58	63.04	11.82
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.24	0.25	0.20	0.23	0.03	0.26	0.30	0.17	0.24	0.07
Si	0.18	0.00	0.00	0.06	0.10	0.19	0.00	0.00	0.06	0.11
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	74.54	77.89	56.66	69.70	11.41	39.99	43.95	22.32	35.42	11.52
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	1.21	0.49	0.78	0.83	0.36	1.17	0.50	0.55	0.74	0.37
S	0.68	0.48	0.55	0.57	0.10	0.63	0.47	0.37	0.49	0.13
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	23.16	20.88	41.81	28.62	11.48	57.76	54.78	76.58	63.04	11.82

Table E-179 Experiment 6 % wt of Element and % Atomic of No. 2 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.60) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	25.83	16.62	29.36	23.94	6.58	61.27	48.05	65.29	58.20	9.02
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.28	0.00	0.94	0.41	0.48	0.30	0.00	0.93	0.41	0.47
Si	0.29	0.00	0.00	0.10	0.17	0.30	0.00	0.00	0.10	0.17
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	71.61	81.69	68.49	73.93	6.90	36.53	50.81	32.75	40.03	9.53
Zr	0.00	1.00	0.00	0.33	0.58	0.00	0.38	0.00	0.13	0.22
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.41	0.00	0.00	0.14	0.24	0.19	0.00	0.00	0.06	0.11
P	1.03	0.26	0.73	0.67	0.39	0.94	0.29	0.63	0.62	0.33
S	0.54	0.43	0.47	0.48	0.06	0.48	0.47	0.39	0.45	0.05
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-180 Experiment 6 % wt of Element and % Atomic of No. 3 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.70) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	7.87	21.62	18.89	16.13	7.28	26.64	53.16	51.51	43.77	14.86
O	2.85	3.60	0.00	2.15	1.90	7.24	6.65	0.00	4.63	4.02
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Si	0.38	0.16	0.18	0.24	0.12	0.54	0.16	0.21	0.30	0.21
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	86.59	73.22	79.14	79.65	6.70	63.00	38.71	46.42	49.38	12.41
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.62	0.00	0.00	0.21	0.36	0.40	0.00	0.00	0.13	0.23
P	1.00	0.83	0.88	0.90	0.09	1.32	0.79	0.94	1.02	0.27
S	0.69	0.58	0.91	0.73	0.17	0.87	0.53	0.93	0.78	0.22
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-181 Experiment 6 % wt of Element and % Atomic of No. 3 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.70) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	20.91	7.01	22.17	16.70	8.41	54.81	23.74	56.44	45.00	18.43
O	0.00	3.88	0.00	1.29	2.24	0.00	9.87	0.00	3.29	5.70
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Si	0.16	0.26	0.16	0.19	0.06	0.18	0.38	0.18	0.25	0.12
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	77.16	85.85	75.69	79.57	5.49	43.50	62.49	41.45	49.15	11.60
Zr	0.45	0.45	0.00	0.30	0.26	0.18	0.29	0.00	0.16	0.15
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.18	0.00	0.06	0.10	0.00	0.19	0.00	0.06	0.11
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.70	1.45	1.25	1.13	0.39	0.72	1.90	1.23	1.28	0.59
S	0.62	0.91	0.74	0.76	0.15	0.61	1.16	0.70	0.82	0.30
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-182 Experiment 6 % wt of Element and % Atomic of No. 3 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.70) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	10.07	13.01	18.46	13.85	4.26	33.39	40.74	50.89	41.67	8.79
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	2.01	0.00	0.00	0.67	1.16	2.97	0.00	0.00	0.99	1.71
Si	0.28	0.00	0.00	0.09	0.16	0.40	0.00	0.00	0.13	0.23
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	86.20	85.30	79.87	83.79	3.42	61.49	57.47	47.35	55.44	7.29
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.25	0.00	0.00	0.08	0.14	0.25	0.00	0.00	0.08	0.14
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.39	0.00	0.13	0.23	0.00	0.23	0.00	0.08	0.13
P	0.57	0.75	1.00	0.77	0.22	0.73	0.92	1.07	0.91	0.17
S	0.62	0.54	0.68	0.61	0.07	0.78	0.63	0.70	0.70	0.08
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-183 Experiment 6 % wt of Element and % Atomic of No. 4 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.75) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	5.33	4.90	0.00	3.41	2.96	19.90	19.07	0.00	12.99	11.26
O	1.37	0.00	0.00	0.46	0.79	3.85	0.00	0.00	1.28	2.22
Al	0.16	0.14	0.00	0.10	0.09	0.26	0.24	0.00	0.17	0.14
Si	0.44	0.22	0.25	0.30	0.12	0.69	0.36	0.48	0.51	0.17
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	90.91	93.16	98.38	94.15	3.83	72.95	78.02	97.19	82.72	12.79
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.69	0.17	0.22	0.36	0.29	0.77	0.20	0.30	0.42	0.30
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.60	0.72	0.56	0.63	0.08	0.87	1.08	0.99	0.98	0.11
S	0.50	0.70	0.60	0.60	0.10	0.70	1.02	1.03	0.92	0.19
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-184 Experiment 6 % wt of Element and % Atomic of No. 4 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.75) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	1.49	2.32	2.30	2.04	0.47	6.47	9.81	9.42	8.57	1.83
O	0.00	0.00	1.19	0.40	0.69	0.00	0.00	3.67	1.22	2.12
Al	0.00	0.11	0.34	0.15	0.17	0.00	0.21	0.61	0.27	0.31
Si	0.21	0.23	0.67	0.37	0.26	0.39	0.41	1.18	0.66	0.45
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	96.26	95.24	93.66	95.05	1.31	89.97	86.58	82.34	86.30	3.82
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.22	0.48	0.10	0.27	0.19	0.14	0.39	0.07	0.20	0.17
P	1.02	0.82	0.97	0.94	0.10	1.72	1.35	1.54	1.54	0.19
S	0.80	0.79	0.76	0.78	0.02	1.30	1.26	1.17	1.24	0.07
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-185 Experiment 6 % wt of Element and % Atomic of No. 4 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.75) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.32	2.46	2.81	2.53	0.25	9.81	10.38	11.68	10.62	0.96
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Si	0.18	0.00	0.17	0.12	0.10	0.32	0.00	0.30	0.21	0.18
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	95.50	95.22	94.89	95.20	0.31	86.66	86.28	84.67	85.87	1.06
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.47	0.00	0.16	0.27	0.00	0.37	0.00	0.12	0.21
P	1.10	0.99	1.00	1.03	0.06	1.80	1.61	1.61	1.67	0.11
S	0.90	0.86	1.13	0.96	0.15	1.42	1.36	1.75	1.51	0.21
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.01	-

Table E-186 Experiment 6 % wt of Element and % Atomic of No. 5 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.89) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.25	13.92	1.93	6.03	6.83	9.06	42.42	8.23	19.90	19.50
O	1.59	0.00	0.00	0.53	0.92	4.81	0.00	0.00	1.60	2.78
Al	0.37	0.00	0.00	0.12	0.22	0.67	0.00	0.00	0.22	0.39
Si	0.87	0.31	0.08	0.42	0.41	1.51	0.40	0.14	0.68	0.72
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	92.48	83.17	95.25	90.30	6.33	80.46	54.52	87.60	74.19	17.41
Zr	0.00	0.52	0.00	0.17	0.30	0.00	0.24	0.00	0.08	0.14
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.30	0.00	0.00	0.10	0.18	0.36	0.00	0.00	0.12	0.21
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.28	0.00	0.55	0.28	0.28	0.21	0.00	0.45	0.22	0.22
P	0.93	1.26	1.24	1.14	0.18	1.46	1.49	2.06	1.67	0.34
S	0.78	0.82	0.95	0.85	0.09	1.18	0.93	1.52	1.21	0.30
Mg	0.08	0.00	0.00	0.03	0.05	0.16	0.00	0.00	0.05	0.09
Na	0.07	0.00	0.00	0.02	0.04	0.13	0.00	0.00	0.04	0.08
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-187 Experiment 6 % wt of Element and % Atomic of No. 5 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.89) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	6.90	10.49	7.89	8.43	1.85	25.35	34.93	28.07	29.45	4.94
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.34	0.11	0.20	0.00	0.00	0.54	0.18	0.31
Si	0.27	0.19	0.30	0.25	0.06	0.43	0.27	0.45	0.38	0.10
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	90.91	87.80	89.88	89.53	1.58	71.82	62.87	68.77	67.82	4.55
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.42	0.00	0.00	0.14	0.24	0.29	0.00	0.00	0.10	0.17
P	0.84	0.88	0.90	0.87	0.03	1.20	1.14	1.24	1.19	0.05
S	0.66	0.63	0.70	0.66	0.04	0.91	0.79	0.93	0.88	0.08
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-188 Experiment 6 % wt of Element and % Atomic of No. 5 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.89) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.12	8.79	10.21	7.04	4.32	8.60	28.25	34.14	23.66	13.37
O	1.94	4.41	0.00	2.12	2.21	5.91	10.63	0.00	5.51	5.33
Al	0.26	0.00	0.00	0.09	0.15	0.46	0.00	0.00	0.15	0.27
Si	0.64	0.31	0.00	0.32	0.32	1.11	0.42	0.00	0.51	0.56
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	93.27	84.18	87.53	88.33	4.60	81.33	58.18	62.96	67.49	12.22
Zr	0.00	0.40	0.00	0.13	0.23	0.00	0.19	0.00	0.06	0.11
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.10	0.17	0.00	0.09	0.09	0.13	0.16	0.00	0.10	0.09
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.13	0.00	0.00	0.04	0.08	0.10	0.00	0.00	0.03	0.06
P	0.77	1.02	1.54	1.11	0.39	1.20	1.27	2.00	1.49	0.44
S	0.76	0.74	0.72	0.74	0.02	1.16	0.89	0.90	0.98	0.15
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-189 Experiment 6 % wt of Element and % Atomic of No. 6 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.00) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	22.06	17.61	8.18	15.95	7.09	56.24	49.38	28.97	44.86	14.18
O	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Al	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Si	0.45	0.00	0.00	0.15	0.26	0.50	0.00	0.00	0.17	0.29
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	75.62	80.44	89.96	82.01	7.30	41.45	48.52	68.51	52.83	14.03
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	1.04	1.20	1.10	1.11	0.08	1.03	1.30	1.52	1.28	0.25
S	0.82	0.76	0.76	0.78	0.03	0.78	0.80	1.00	0.86	0.12
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-190 Experiment 6 % wt of Element and % Atomic of No. 6 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.00) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	17.45	11.33	20.48	16.42	4.66	45.70	36.77	54.07	45.51	8.65
O	4.89	0.00	0.00	1.63	2.82	9.61	0.00	0.00	3.20	5.55
Al	0.40	0.00	0.00	0.13	0.23	0.46	0.00	0.00	0.15	0.27
Si	0.39	0.00	0.00	0.13	0.23	0.44	0.00	0.00	0.15	0.25
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	75.53	86.23	77.75	79.84	5.65	42.54	60.20	44.14	48.96	9.77
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.46	0.00	0.00	0.15	0.27	0.36	0.00	0.00	0.12	0.21
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.49	1.58	1.14	1.07	0.55	0.50	1.99	1.17	1.22	0.75
S	0.40	0.86	0.63	0.63	0.23	0.40	1.05	0.62	0.69	0.33
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-191 Experiment 6 % wt of Element and % Atomic of No. 6 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.00) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	10.21	14.32	16.06	13.53	3.00	33.70	42.78	42.14	39.54	5.07
O	0.00	0.00	6.66	2.22	3.85	0.00	0.00	13.13	4.38	7.58
Al	0.37	0.00	0.00	0.12	0.21	0.54	0.00	0.00	0.18	0.31
Si	0.68	0.61	0.25	0.51	0.23	0.96	0.78	0.28	0.67	0.35
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	84.56	80.76	74.84	80.05	4.90	60.01	51.87	42.24	51.37	8.90
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	1.64	1.22	0.00	0.95	0.85	1.62	1.10	0.00	0.91	0.83
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.75	0.72	1.47	0.98	0.42	0.96	0.84	1.50	1.10	0.35
S	1.79	2.36	0.72	1.62	0.83	2.21	2.64	0.70	1.85	1.02
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-192 Experiment 6 % wt of Element and % Atomic of No. 7 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.26) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	8.49	7.60	8.03	8.04	0.44	29.29	26.46	28.91	28.22	1.54
O	0.96	0.79	0.00	0.58	0.51	2.48	1.90	0.00	1.46	1.30
Al	0.27	0.13	0.00	0.13	0.14	0.42	0.20	0.00	0.21	0.21
Si	0.32	0.36	0.19	0.29	0.09	0.47	0.54	0.29	0.43	0.13
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	88.71	89.64	90.99	89.78	1.15	65.83	69.39	70.42	68.55	2.41
Zr	0.00	0.27	0.78	0.35	0.40	0.00	0.14	0.37	0.17	0.19
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.05	0.00	0.02	0.03	0.00	0.04	0.00	0.01	0.03
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.21	0.23	0.00	0.15	0.13	0.14	0.15	0.00	0.10	0.08
P	0.57	0.51	0.00	0.36	0.31	0.76	0.66	0.00	0.47	0.41
S	0.48	0.41	0.00	0.30	0.26	0.62	0.53	0.00	0.38	0.33
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-193 Experiment 6 % wt of Element and % Atomic of No. 7 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.26) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	11.52	4.23	6.67	7.47	3.71	35.20	16.90	24.22	25.44	9.21
O	2.93	0.00	0.42	1.12	1.58	6.72	0.00	1.10	2.61	3.61
Al	0.27	0.13	0.07	0.16	0.10	0.36	0.22	0.10	0.23	0.13
Si	0.58	0.24	0.42	0.41	0.17	0.76	0.41	0.64	0.60	0.18
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	81.33	94.51	91.15	89.00	6.85	53.45	81.12	72.77	69.11	14.19
Zr	0.00	0.00	0.43	0.14	0.25	0.00	0.00	0.23	0.08	0.13
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.29	0.00	0.00	0.10	0.17	0.26	0.00	0.00	0.09	0.15
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.61	0.00	0.29	0.30	0.31	0.35	0.00	0.21	0.19	0.18
P	1.51	0.47	0.26	0.75	0.67	1.79	0.73	0.35	0.96	0.75
S	0.96	0.41	0.31	0.56	0.35	1.10	0.62	0.41	0.71	0.35
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-194 Experiment 6 % wt of Element and % Atomic of No. 7 Iron nugget (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.26) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	4.78	8.56	7.88	7.07	2.01	18.92	29.51	26.05	24.83	5.40
O	0.00	0.84	1.47	0.77	0.74	0.00	2.19	3.36	1.85	1.71
Al	0.00	0.13	0.20	0.11	0.10	0.00	0.19	0.29	0.16	0.15
Si	0.21	0.63	0.41	0.42	0.21	0.36	0.92	0.59	0.62	0.28
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	93.63	88.66	87.92	90.07	3.11	79.78	65.76	67.29	70.94	7.69
Zr	0.86	0.00	0.00	0.29	0.50	0.45	0.00	0.00	0.15	0.26
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	0.00	0.00	0.15	0.05	0.08	0.00	0.00	0.13	0.04	0.08
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.38	0.20	0.31	0.30	0.09	0.28	0.13	0.18	0.20	0.08
P	0.00	0.52	0.99	0.50	0.50	0.00	0.69	1.26	0.65	0.63
S	0.14	0.47	0.69	0.43	0.27	0.21	0.61	0.86	0.56	0.33
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-195 Experiment 6 % wt of Element and % Atomic of No. 8 (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.76) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	13.98	4.66	-	0.00	0.00	31.52	10.51	-
O	17.19	8.11	16.06	13.79	4.95	38.46	21.28	27.19	28.98	8.73
Al	2.57	15.28	3.19	7.01	7.17	3.40	30.11	3.20	12.24	15.48
Si	3.56	0.77	3.95	2.76	1.73	4.54	0.90	3.81	3.08	1.93
K	0.21	1.15	0.00	0.45	0.61	0.19	1.13	0.00	0.44	0.61
Fe	59.97	58.59	41.57	53.38	10.25	38.44	33.07	20.16	30.56	9.40
Zr	0.00	0.00	1.02	0.34	-	0.00	0.00	0.30	0.10	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	14.60	13.49	19.37	15.82	3.12	13.03	10.61	13.09	12.24	1.41
Ti	0.59	0.00	0.00	0.20	0.34	0.44	0.00	0.00	0.15	0.25
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.62	2.30	0.00	0.97	1.19	0.71	2.58	0.00	1.10	1.33
S	0.69	0.32	0.86	0.62	0.28	0.77	0.33	0.73	0.61	0.24
Mg	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	0.00	0.00	13.98	4.66	-	0.00	0.00	31.52	10.51	-

Table E-196 Experiment 6 % wt of Element and % Atomic of No. 8 (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.76) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	5.67	11.31	14.02	10.33	4.26	14.26	28.63	34.26	25.72	10.31
O	20.21	13.32	10.57	14.70	4.97	38.17	25.31	20.17	27.88	9.27
Al	1.77	1.20	1.38	1.45	0.29	1.98	1.36	1.53	1.62	0.32
Si	3.30	2.73	2.42	2.82	0.45	3.55	2.96	2.55	3.02	0.51
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	48.76	56.19	57.86	54.27	4.84	26.38	30.59	31.79	29.59	2.84
Zr	0.00	1.31	1.33	0.88	0.76	0.00	0.44	0.44	0.29	0.25
Mn	0.00	0.00	0.43	0.14	0.25	0.00	0.00	0.24	0.08	0.14
Ca	17.31	13.14	10.86	13.77	3.27	13.05	9.97	7.98	10.33	2.56
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.42	0.00	0.11	0.18	0.22	0.20	0.00	0.05	0.08	0.10
P	0.41	0.00	0.00	0.14	0.24	0.40	0.00	0.00	0.13	0.23
S	2.15	0.79	1.04	1.33	0.72	2.02	0.75	0.97	1.25	0.68
Mg	0.00	0.00	0.14	0.05	0.08	0.00	0.00	0.16	0.05	0.09
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-197 Experiment 6 % wt of Element and % Atomic of No. 8 (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.76) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	18.70	9.33	0.00	9.34	9.35	42.83	25.68	0.00	22.84	21.56
O	9.63	11.51	11.46	10.87	1.07	16.55	23.79	26.21	22.18	5.03
Al	1.59	1.17	19.41	7.39	10.41	1.62	1.44	33.34	12.13	18.37
Si	3.03	1.80	2.56	2.46	0.62	2.97	2.12	2.61	2.57	0.43
K	0.00	0.00	0.90	0.30	0.52	0.00	0.00	0.77	0.26	0.44
Fe	49.63	66.09	45.83	53.85	10.77	24.45	39.13	22.55	28.71	9.07
Zr	1.44	1.22	0.00	0.89	0.78	0.43	0.44	0.00	0.29	0.25
Mn	0.38	0.47	0.00	0.28	0.25	0.19	0.28	0.00	0.16	0.14
Ca	14.13	7.58	16.24	12.65	4.52	9.70	6.25	11.13	9.03	2.51
Ti	0.00	0.00	0.29	0.10	0.17	0.00	0.00	0.17	0.06	0.10
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.11	0.00	0.00	0.04	0.06	0.05	0.00	0.00	0.02	0.03
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	1.23	0.84	3.30	1.79	1.32	1.06	0.87	3.23	1.72	1.31
Mg	0.14	0.00	0.00	0.05	0.08	0.16	0.00	0.00	0.05	0.09
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-198 Experiment 6 % wt of Element and % Atomic of No. 9 (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 2.26) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	25.43	3.04	11.81	13.43	11.28	49.54	10.08	30.02	29.88	19.73
O	13.72	9.38	10.70	11.27	2.22	20.07	23.31	20.43	21.27	1.78
Al	1.14	1.47	1.75	1.45	0.31	0.99	2.17	1.98	1.71	0.63
Si	3.10	1.49	2.99	2.53	0.90	2.59	2.11	3.25	2.65	0.57
K	0.18	0.00	0.14	0.11	0.09	0.11	0.00	0.11	0.07	0.06
Fe	37.07	78.20	53.35	56.21	20.71	15.53	55.67	29.17	33.46	20.41
Zr	0.98	0.00	0.00	0.33	0.57	0.25	0.00	0.00	0.08	0.14
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	16.00	5.36	16.64	12.67	6.34	9.34	5.31	12.68	9.11	3.69
Ti	0.47	0.00	0.50	0.32	0.28	0.23	0.00	0.32	0.18	0.17
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.20	0.00	0.00	0.07	-	0.07	0.00	0.00	0.02	-
P	0.00	0.72	0.49	0.40	0.37	0.00	0.92	0.48	0.47	0.46
S	1.60	0.34	1.63	1.19	0.74	1.16	0.42	1.56	1.05	0.58
Mg	0.11	0.00	0.00	0.04	0.06	0.11	0.00	0.00	0.04	0.06
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-199 Experiment 6 % wt of Element and % Atomic of No. 9 (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 2.26) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	10.27	19.66	7.55	12.49	6.35	27.48	40.00	18.79	28.76	10.66
O	10.39	16.18	16.73	14.43	3.51	20.87	24.71	31.25	25.61	5.25
Al	1.32	1.81	1.91	1.68	0.32	1.58	1.64	2.12	1.78	0.30
Si	2.56	3.60	3.27	3.14	0.53	2.93	3.13	3.48	3.18	0.28
K	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Fe	61.27	31.87	41.05	44.73	15.04	35.26	13.95	21.97	23.73	10.76
Zr	0.00	0.90	1.29	0.73	0.66	0.00	0.24	0.42	0.22	0.21
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	11.82	22.59	23.57	19.33	6.52	9.48	13.77	17.58	13.61	4.05
Ti	0.20	0.29	0.00	0.16	0.15	0.14	0.15	0.00	0.10	0.08
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.71	0.00	0.00	0.24	0.41	0.74	0.00	0.00	0.25	0.43
S	1.21	2.94	4.42	2.86	1.61	1.22	2.24	4.12	2.53	1.47
Mg	0.24	0.17	0.22	0.21	0.04	0.31	0.17	0.27	0.25	0.07
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-200 Experiment 6 % wt of Element and % Atomic of No. 9 (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 2.26) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	35.02	16.86	2.72	18.20	16.19	59.02	36.34	9.13	34.83	24.98
O	14.06	16.51	8.02	12.86	4.37	17.80	26.71	20.21	21.57	4.61
Al	1.43	1.22	1.02	1.22	0.21	1.07	1.17	1.53	1.26	0.24
Si	3.02	3.05	1.75	2.61	0.74	2.18	2.81	2.51	2.50	0.32
K	0.20	0.00	0.00	0.07	0.12	0.11	0.00	0.00	0.04	0.06
Fe	24.68	39.81	74.09	46.19	25.32	8.95	18.45	53.49	26.96	23.46
Zr	0.71	1.16	0.00	0.62	0.58	0.16	0.33	0.00	0.16	0.17
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	19.16	18.56	9.98	15.90	5.14	9.68	11.99	10.04	10.57	1.24
Ti	0.18	0.35	0.00	0.18	0.18	0.08	0.19	0.00	0.09	0.10
Au	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P	0.00	0.00	0.95	0.32	0.55	0.00	0.00	1.23	0.41	0.71
S	1.53	2.37	1.48	1.79	0.50	0.96	1.91	1.87	1.58	0.54
Mg	0.00	0.11	0.00	0.04	0.06	0.00	0.12	0.00	0.04	0.07
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-

Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-201 Experiment 6 % wt of Element and % Atomic of No. 1 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.50) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	42.60	40.89	41.31	41.60	0.89	59.88	58.62	59.11	59.20	0.64
Al	11.81	10.27	10.12	10.73	0.94	9.84	8.73	8.58	9.05	0.69
Si	19.69	20.41	20.36	20.15	0.40	15.77	16.67	16.59	16.34	0.50
K	1.41	1.62	1.49	1.51	0.11	0.81	0.95	0.87	0.88	0.07
Fe	2.61	3.86	3.62	3.36	0.66	1.05	1.58	1.48	1.37	0.28
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	20.28	21.48	21.86	21.21	0.82	11.38	12.30	12.49	12.06	0.59
Ti	0.41	0.58	0.65	0.55	0.12	0.19	0.28	0.31	0.26	0.06
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.24	0.00	0.00	0.08	0.14	0.17	0.00	0.00	0.06	0.10
Mg	0.57	0.50	0.60	0.56	0.05	0.53	0.47	0.56	0.52	0.05
Na	0.39	0.40	0.00	0.26	0.23	0.38	0.40	0.00	0.26	0.23
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-202 Experiment 6 % wt of Element and % Atomic of No. 1 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.50) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	42.17	41.01	40.57	41.25	0.83	60.06	58.65	58.51	59.07	0.86
Al	9.68	9.59	9.54	9.60	0.07	8.17	8.13	8.16	8.15	0.02
Si	20.13	21.00	20.30	20.48	0.46	16.33	17.11	16.67	16.70	0.39
K	1.46	1.49	1.42	1.46	0.04	0.85	0.87	0.84	0.85	0.02
Fe	2.70	3.07	4.88	3.55	1.17	1.10	1.26	2.02	1.46	0.49
Zr	1.23	0.00	0.00	0.41	0.71	0.31	0.00	0.00	0.10	0.18
Mn	0.47	0.00	0.00	0.16	0.27	0.19	0.00	0.00	0.06	0.11
Ca	20.47	22.07	21.33	21.29	0.80	11.64	12.60	12.28	12.17	0.49
Ti	0.43	0.51	0.52	0.49	0.05	0.20	0.24	0.25	0.23	0.03
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.27	0.25	0.45	0.32	0.11	0.19	0.18	0.32	0.23	0.08
Mg	0.66	0.57	0.60	0.61	0.05	0.62	0.54	0.57	0.58	0.04

Na	0.34	0.42	0.39	0.38	0.04	0.33	0.42	0.39	0.38	0.05
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-203 Experiment 6 % wt of Element and % Atomic of No. 1 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.50) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.53	0.00	0.00	0.84	1.46	4.47	0.00	0.00	1.49	2.58
O	47.09	35.22	37.89	40.07	6.23	62.45	53.33	56.16	57.31	4.67
Al	8.61	9.10	9.00	8.90	0.26	6.77	8.18	7.91	7.62	0.75
Si	18.58	20.20	19.53	19.44	0.81	14.04	17.42	16.49	15.98	1.75
K	1.20	1.73	1.69	1.54	0.30	0.65	1.07	1.02	0.91	0.23
Fe	2.37	4.15	3.97	3.50	0.98	0.90	1.80	1.69	1.46	0.49
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.32	0.00	0.55	0.29	0.28	0.12	0.00	0.24	0.12	0.12
Ca	17.50	27.87	25.85	23.74	5.50	9.27	16.84	15.29	13.80	4.00
Ti	0.45	0.66	0.63	0.58	0.11	0.20	0.33	0.31	0.28	0.07
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.28	0.26	0.00	0.18	0.16	0.19	0.20	0.00	0.13	0.11
Mg	0.55	0.52	0.51	0.53	0.02	0.48	0.52	0.50	0.50	0.02
Na	0.52	0.29	0.39	0.40	0.12	0.48	0.31	0.40	0.40	0.09
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-204 Experiment 6 % wt of Element and % Atomic of No. 2 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.60) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	5.95	6.98	8.70	7.21	1.39	10.09	11.84	14.52	12.15	2.23
O	47.04	45.66	45.41	46.04	0.88	59.87	58.12	56.88	58.29	1.50
Al	8.20	8.06	7.79	8.02	0.21	6.19	6.08	5.78	6.02	0.21
Si	17.70	17.67	17.07	17.48	0.36	12.83	12.81	12.18	12.61	0.37
K	1.11	1.08	1.15	1.11	0.04	0.58	0.56	0.59	0.58	0.02
Fe	0.84	1.20	1.29	1.11	0.24	0.30	0.44	0.46	0.40	0.09
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	17.38	18.11	17.34	17.61	0.43	8.83	9.20	8.67	8.90	0.27
Ti	0.35	0.31	0.33	0.33	0.02	0.15	0.13	0.14	0.14	0.01
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.32	0.00	0.00	0.11	0.18	0.20	0.00	0.00	0.07	0.12
Mg	0.67	0.49	0.53	0.56	0.09	0.57	0.41	0.44	0.47	0.09

Na	0.43	0.46	0.39	0.43	0.04	0.38	0.40	0.34	0.37	0.03
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-205 Experiment 6 % wt of Element and % Atomic of No. 2 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.60) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	15.63	5.21	9.02	0.00	0.00	24.17	8.06	13.95
O	50.92	44.87	45.92	47.24	3.23	67.17	62.25	53.33	60.92	7.02
Al	8.84	10.48	7.25	8.86	1.62	6.91	8.62	4.99	6.84	1.82
Si	19.51	18.90	15.16	17.86	2.36	14.66	14.93	10.03	13.21	2.75
K	1.07	1.32	0.85	1.08	0.24	0.58	0.75	0.40	0.58	0.18
Fe	1.05	1.38	0.80	1.08	0.29	0.40	0.55	0.26	0.40	0.15
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	17.27	22.03	13.91	17.74	4.08	9.09	12.20	6.45	9.25	2.88
Ti	0.00	0.52	0.00	0.17	0.30	0.00	0.24	0.00	0.08	0.14
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.65	0.50	0.49	0.55	0.09	0.57	0.46	0.37	0.47	0.10
Na	0.68	0.00	0.00	0.23	0.39	0.63	0.00	0.00	0.21	0.36
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-206 Experiment 6 % wt of Element and % Atomic of No. 2 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.60) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	42.08	40.75	39.24	40.69	1.42	59.76	58.55	57.44	58.58	1.16
Al	8.95	8.98	9.06	9.00	0.06	7.53	7.65	7.86	7.68	0.17
Si	20.57	20.49	19.56	20.21	0.56	16.64	16.77	16.31	16.57	0.24
K	1.44	1.59	1.70	1.58	0.13	0.84	0.94	1.02	0.93	0.09
Fe	1.85	1.53	2.56	1.98	0.53	0.75	0.63	1.07	0.82	0.23
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	24.47	26.17	27.88	26.17	1.71	13.87	15.01	16.29	15.06	1.21
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.64	0.48	0.00	0.37	0.33	0.60	0.46	0.00	0.35	0.31

Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-207 Experiment 6 % wt of Element and % Atomic of No. 3 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.70) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	39.72	36.86	41.38	39.32	2.29	57.85	55.48	59.50	57.61	2.02
Al	8.42	7.98	8.87	8.42	0.45	7.27	7.12	7.56	7.32	0.22
Si	19.14	18.47	19.27	18.96	0.43	15.88	15.83	15.78	15.83	0.05
K	1.55	1.71	1.69	1.65	0.09	0.92	1.05	0.99	0.99	0.07
Fe	1.65	3.03	2.23	2.30	0.69	0.69	1.31	0.92	0.97	0.31
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	28.90	31.95	26.56	29.14	2.70	16.80	19.20	15.24	17.08	1.99
Ti	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.60	0.00	0.00	0.20	0.35	0.58	0.00	0.00	0.19	0.33
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	99.99	-

Table E-208 Experiment 6 % wt of Element and % Atomic of No. 3 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.70) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	6.28	0.00	0.00	2.09	3.63	10.96	0.00	0.00	3.65	6.33
O	43.93	47.36	41.32	44.20	3.03	57.55	65.11	59.38	60.68	3.94
Al	7.22	8.38	8.00	7.87	0.59	5.60	6.83	6.81	6.41	0.70
Si	16.52	18.07	19.22	17.94	1.35	12.33	14.16	15.73	14.07	1.70
K	1.17	1.10	1.45	1.24	0.19	0.62	0.62	0.85	0.70	0.13
Fe	1.56	1.09	1.39	1.35	0.24	0.59	0.43	0.57	0.53	0.09
Zr	0.00	1.69	0.00	0.56	0.98	0.00	0.41	0.00	0.14	0.24
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	22.27	21.75	28.01	24.01	3.47	11.65	11.94	16.07	13.22	2.47
Ti	0.47	0.00	0.00	0.16	0.27	0.21	0.00	0.00	0.07	0.12
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.58	0.56	0.61	0.58	0.03	0.50	0.51	0.58	0.53	0.04

Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-209 Experiment 6 % wt of Element and % Atomic of No. 3 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.70) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	39.66	43.53	38.22	40.47	2.75	57.79	61.45	56.92	58.72	2.40
Al	8.75	8.89	8.00	8.55	0.48	7.56	7.44	7.07	7.36	0.26
Si	18.98	19.01	17.75	18.58	0.72	15.75	15.28	15.06	15.36	0.35
K	1.25	1.33	1.64	1.41	0.21	0.75	0.77	1.00	0.84	0.14
Fe	2.24	1.80	2.48	2.17	0.34	0.93	0.73	1.06	0.91	0.17
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	28.42	25.44	31.14	28.33	2.85	16.53	14.34	18.51	16.46	2.09
Ti	0.00	0.00	0.75	0.25	0.43	0.00	0.00	0.37	0.12	0.21
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mg	0.71	0.00	0.00	0.24	0.41	0.68	0.00	0.00	0.23	0.39
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-210 Experiment 6 % wt of Element and % Atomic of No. 4 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.75) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	28.06	38.54	29.86	32.15	5.60	45.87	57.06	47.93	50.29	5.96
Al	7.60	7.40	7.75	7.58	0.18	7.36	6.49	7.38	7.08	0.51
Si	18.03	17.29	18.20	17.84	0.48	16.79	14.59	16.64	16.01	1.23
K	1.63	1.30	1.61	1.51	0.19	1.09	0.78	1.06	0.98	0.17
Fe	2.56	1.39	2.53	2.16	0.67	1.20	0.59	1.16	0.98	0.34
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.59	0.00	0.00	0.20	0.34	0.28	0.00	0.00	0.09	0.16
Ca	39.80	32.22	38.43	36.82	4.04	25.97	19.04	24.63	23.21	3.68
Ti	0.62	0.60	0.78	0.67	0.10	0.34	0.29	0.42	0.35	0.07
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.44	0.44	0.42	0.43	0.01	0.36	0.33	0.33	0.34	0.02
Mg	0.41	0.51	0.43	0.45	0.05	0.45	0.50	0.45	0.47	0.03

Na	0.25	0.31	0.00	0.19	0.16	0.28	0.32	0.00	0.20	0.17
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-211 Experiment 6 % wt of Element and % Atomic of No. 4 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.75) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	37.93	38.24	40.14	38.77	1.20	56.03	56.34	58.17	56.85	1.16
Al	8.50	8.29	8.37	8.39	0.11	7.45	7.25	7.19	7.30	0.14
Si	19.01	18.81	18.72	18.85	0.15	16.00	15.79	15.45	15.75	0.28
K	1.00	1.04	1.06	1.03	0.03	0.61	0.62	0.63	0.62	0.01
Fe	0.96	0.82	0.87	0.88	0.07	0.41	0.35	0.36	0.37	0.03
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.32	0.00	0.00	0.11	0.18	0.14	0.00	0.00	0.05	0.08
Ca	30.37	30.84	28.96	30.06	0.98	17.91	18.14	16.75	17.60	0.75
Ti	0.53	0.51	0.52	0.52	0.01	0.26	0.25	0.25	0.25	0.01
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.60	0.63	0.52	0.58	0.06	0.45	0.46	0.38	0.43	0.04
Mg	0.54	0.53	0.56	0.54	0.02	0.53	0.51	0.53	0.52	0.01
Na	0.23	0.29	0.29	0.27	0.03	0.23	0.29	0.29	0.27	0.03
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-212 Experiment 6 % wt of Element and % Atomic of No. 4 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.75) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	33.21	34.77	34.83	34.27	0.92	51.70	53.08	53.17	52.65	0.82
Al	7.64	7.95	7.85	7.81	0.16	7.05	7.20	7.11	7.12	0.08
Si	17.62	18.49	18.28	18.13	0.45	15.63	16.08	15.89	15.87	0.23
K	1.47	1.53	1.39	1.46	0.07	0.94	0.96	0.87	0.92	0.05
Fe	2.59	2.07	2.01	2.22	0.32	1.15	0.91	0.88	0.98	0.15
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.47	0.00	0.00	0.16	0.27	0.22	0.00	0.00	0.07	0.13
Ca	35.15	33.28	33.86	34.10	0.96	21.84	20.28	20.63	20.92	0.82
Ti	0.65	0.64	0.50	0.60	0.08	0.34	0.32	0.26	0.31	0.04
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.43	0.48	0.45	0.45	0.03	0.34	0.36	0.34	0.35	0.01
Mg	0.47	0.53	0.54	0.51	0.04	0.49	0.53	0.54	0.52	0.03

Na	0.29	0.27	0.30	0.29	0.02	0.31	0.28	0.31	0.30	0.02
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-213 Experiment 6 % wt of Element and % Atomic of No. 5 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.89) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	2.69	22.04	0.00	8.24	12.02	5.18	34.96	0.00	13.38	18.87
O	28.09	34.76	28.85	30.57	3.65	44.96	41.39	46.84	44.40	2.77
Al	6.23	5.48	6.92	6.21	0.72	5.96	3.87	6.68	5.50	1.46
Si	14.13	11.22	16.48	13.94	2.63	13.05	7.61	15.29	11.98	3.95
K	0.90	0.82	1.20	0.97	0.20	0.63	0.40	0.80	0.61	0.20
Fe	3.16	3.23	1.23	2.54	1.14	1.44	1.10	0.58	1.04	0.43
Zr	0.98	0.00	0.00	0.33	0.57	0.29	0.00	0.00	0.10	0.17
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	42.38	22.46	43.86	36.24	11.95	27.41	10.67	28.68	22.25	10.05
Ti	0.76	0.00	0.64	0.46	0.41	0.40	0.00	0.35	0.25	0.22
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.22	0.00	0.42	0.21	0.21	0.19	0.00	0.34	0.18	0.17
Mg	0.46	0.00	0.40	0.29	0.25	0.48	0.00	0.43	0.30	0.27
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-214 Experiment 6 % wt of Element and % Atomic of No. 5 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.89) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	8.77	0.00	0.00	2.92	5.06	14.84	0.00	0.00	4.95	8.57
O	44.13	50.93	48.93	48.00	3.49	56.08	67.90	66.20	63.39	6.39
Al	6.80	7.66	7.80	7.42	0.54	5.12	6.05	6.25	5.81	0.60
Si	15.55	17.03	17.36	16.65	0.96	11.26	12.94	13.38	12.53	1.12
K	0.53	0.55	0.60	0.56	0.04	0.28	0.30	0.33	0.30	0.03
Fe	0.68	0.63	0.62	0.64	0.03	0.25	0.24	0.24	0.24	0.01
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	21.99	21.87	23.66	22.51	1.00	11.16	11.64	12.78	11.86	0.83
Ti	0.44	0.32	0.00	0.25	0.23	0.19	0.14	0.00	0.11	0.10
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.44	0.44	0.47	0.45	0.02	0.28	0.29	0.32	0.30	0.02
Mg	0.67	0.57	0.56	0.60	0.06	0.56	0.50	0.50	0.52	0.03

Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-215 Experiment 6 % wt of Element and % Atomic of No. 5 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 0.89) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	31.91	35.13	42.30	36.45	5.32	50.16	54.40	60.38	54.98	5.13
Al	7.59	6.87	7.93	7.46	0.54	7.07	6.31	6.71	6.70	0.38
Si	17.71	15.12	18.18	17.00	1.65	15.85	13.34	14.79	14.66	1.26
K	1.22	1.15	0.87	1.08	0.19	0.78	0.73	0.51	0.67	0.14
Fe	1.32	3.30	1.03	1.88	1.23	0.60	1.46	0.42	0.83	0.56
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	38.70	38.42	28.59	35.24	5.76	24.28	23.75	16.29	21.44	4.47
Ti	0.53	0.00	0.00	0.18	0.31	0.28	0.00	0.00	0.09	0.16
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.40	0.00	0.54	0.31	0.28	0.32	0.00	0.39	0.24	0.21
Mg	0.46	0.00	0.55	0.34	0.30	0.48	0.00	0.51	0.33	0.29
Na	0.15	0.00	0.00	0.05	0.09	0.17	0.00	0.00	0.06	0.10
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-216 Experiment 6 % wt of Element and % Atomic of No. 6 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.00) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	41.32	40.35	40.35	40.67	0.56	60.06	58.68	58.68	59.14	0.80
Al	7.71	7.56	7.56	7.61	0.09	6.64	6.52	6.52	6.56	0.07
Si	15.34	17.12	17.12	16.53	1.03	12.70	14.18	14.18	13.69	0.85
K	0.61	0.64	0.64	0.63	0.02	0.37	0.38	0.38	0.38	0.01
Fe	0.93	0.00	0.00	0.31	0.54	0.39	0.00	0.00	0.13	0.23
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	32.80	33.08	33.08	32.99	-	19.04	19.20	19.20	19.15	-
Ti	0.54	0.00	0.00	0.18	0.31	0.26	0.00	0.00	0.09	0.15
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.74	0.69	0.69	0.71	0.03	0.54	0.50	0.50	0.51	0.02
Mg	0.00	0.56	0.56	0.37	0.32	0.00	0.53	0.53	0.35	0.31

Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-217 Experiment 6 % wt of Element and % Atomic of No. 6 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.00) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	9.96	0.00	3.32	5.75	0.00	16.84	0.00	5.61	9.72
O	47.43	42.64	47.18	45.75	2.70	65.12	54.11	64.85	61.36	6.28
Al	7.46	6.79	7.56	7.27	0.42	6.07	5.11	6.16	5.78	0.58
Si	16.65	14.92	17.00	16.19	1.11	13.02	10.79	13.31	12.37	1.38
K	0.63	0.72	0.73	0.69	0.06	0.36	0.37	0.41	0.38	0.03
Fe	0.57	0.72	0.54	0.61	0.10	0.22	0.26	0.21	0.23	0.03
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	25.59	23.25	25.98	24.94	1.48	14.02	11.78	14.25	13.35	1.36
Ti	0.45	0.00	0.00	0.15	0.26	0.20	0.00	0.00	0.07	0.12
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.58	0.47	0.54	0.53	0.06	0.40	0.29	0.37	0.35	0.06
Mg	0.65	0.53	0.48	0.55	0.09	0.58	0.44	0.43	0.48	0.08
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-218 Experiment 6 % wt of Element and % Atomic of No. 6 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.00) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	1.66	0.55	0.96	0.00	0.00	2.81	0.94	1.62
O	45.03	45.64	43.21	44.63	1.26	63.49	63.48	60.25	62.41	1.87
Al	7.12	7.36	7.44	7.31	0.17	5.95	6.07	6.17	6.06	0.11
Si	16.18	17.40	16.36	16.65	0.66	12.99	13.78	13.03	13.27	0.45
K	0.68	0.72	0.66	0.69	0.03	0.39	0.41	0.38	0.39	0.02
Fe	0.52	0.72	0.46	0.57	0.14	0.21	0.29	0.18	0.23	0.06
Zr	1.39	0.00	0.00	0.46	0.80	0.34	0.00	0.00	0.11	0.20
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	27.56	26.91	28.96	27.81	1.05	15.51	14.94	16.25	15.57	0.66
Ti	0.39	0.00	0.17	0.19	0.20	0.18	0.00	0.08	0.09	0.09
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.51	0.59	0.62	0.57	0.06	0.36	0.41	0.43	0.40	0.04
Mg	0.62	0.66	0.46	0.58	0.10	0.58	0.61	0.42	0.54	0.10

Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-219 Experiment 6 % wt of Element and % Atomic of No. 7 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.26) 1st specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	5.73	0.00	0.00	1.91	3.31	11.87	0.00	0.00	3.96	6.85
O	27.05	37.56	34.65	33.09	5.43	42.09	56.81	54.25	51.05	7.86
Al	5.48	6.52	5.83	5.94	0.53	5.05	5.85	5.41	5.44	0.40
Si	13.38	15.14	13.81	14.11	0.92	11.86	13.05	12.31	12.41	0.60
K	0.56	0.61	0.59	0.59	0.03	0.36	0.38	0.38	0.37	0.01
Fe	3.28	2.74	3.47	3.16	0.38	1.46	1.19	1.56	1.40	0.19
Zr	1.18	0.00	0.00	0.39	0.68	0.32	0.00	0.00	0.11	0.18
Mn	0.63	0.42	0.55	0.53	0.11	0.29	0.19	0.25	0.24	0.05
Ca	41.61	35.78	39.82	39.07	2.99	25.85	21.60	24.88	24.11	2.23
Ti	0.46	0.41	0.53	0.47	0.06	0.24	0.21	0.28	0.24	0.04
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.28	0.31	0.39	0.33	0.06	0.22	0.23	0.30	0.25	0.04
Mg	0.39	0.51	0.37	0.42	0.08	0.40	0.51	0.38	0.43	0.07
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-220 Experiment 6 % wt of Element and % Atomic of No. 7 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.26) 2nd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	30.44	30.44	28.74	29.87	0.98	49.09	49.09	47.21	48.46	1.09
Al	6.34	6.34	6.14	6.27	0.12	6.06	6.06	5.98	6.03	0.05
Si	15.30	15.30	14.78	15.13	0.30	14.06	14.06	13.83	13.98	0.13
K	0.54	0.54	0.62	0.57	0.05	0.36	0.36	0.42	0.38	0.03
Fe	1.63	1.63	1.41	1.56	0.13	0.75	0.75	0.66	0.72	0.05
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Ca	44.22	44.22	46.65	45.03	1.40	28.46	28.46	30.59	29.17	1.23
Ti	0.47	0.47	0.58	0.51	0.06	0.26	0.26	0.32	0.28	0.03
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	0.61	0.61	0.64	0.62	0.02	0.49	0.49	0.53	0.50	0.02
Mg	0.45	0.45	0.43	0.44	0.01	0.48	0.48	0.47	0.48	0.01

Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

Table E-221 Experiment 6 % wt of Element and % Atomic of No. 7 Slag (1425°C, 20 min, mole ratio C/Fe = 1.53/1, Limestone/Al_2O_3+SiO_2 = 1.26) 3rd specimen

Element	% Element					% Atomic				
	1	2	3	average	SD	1	2	3	average	SD
C	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
O	28.44	40.95	35.82	35.07	6.29	47.56	60.03	55.17	54.25	6.29
Al	5.45	6.28	5.88	5.87	0.42	5.40	5.46	5.37	5.41	0.05
Si	13.56	14.48	14.05	14.03	0.46	12.92	12.09	12.32	12.44	0.43
K	1.24	0.50	0.65	0.80	0.39	0.85	0.30	0.41	0.52	0.29
Fe	6.35	1.40	1.89	3.21	2.73	3.04	0.59	0.83	1.49	1.35
Zr	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Mn	0.48	0.00	0.00	0.16	0.28	0.23	0.00	0.00	0.08	0.13
Ca	42.47	34.65	40.06	39.06	4.00	28.35	20.28	24.63	24.42	4.04
Ti	0.50	0.59	0.51	0.53	0.05	0.28	0.29	0.26	0.28	0.02
Au	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cu	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
P	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
S	1.10	0.65	0.62	0.79	0.27	0.92	0.48	0.48	0.63	0.25
Mg	0.41	0.51	0.51	0.48	0.06	0.45	0.49	0.52	0.49	0.04
Na	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Cl	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
Total	100.00	100.00	100.00	100.00	-	100.00	100.00	100.00	100.00	-

E.2 X-Ray Diffraction Spectrometer (XRD)

The sample was characterized for its structures by XRD (Rigaku D/max; model 2000), (Philips; model PW3719 and software X'Pert APD) .The specimens were placed on the glass slide, clamped on the sample holder, and then exposed to X-ray. The anode tube of X-ray was Copper K-alpha. The measurement voltage and current were 40 kV and 30 mA, respectively. The measurement angle (2θ) was from 5 degree to 90 degree with a scanning speed of 5 degree/min under the wide angle mode. One sample was divided into 3 specimens for each measurement. Each specimen was chosen randomly from the whole of the sample.

E.2.1 XK-01

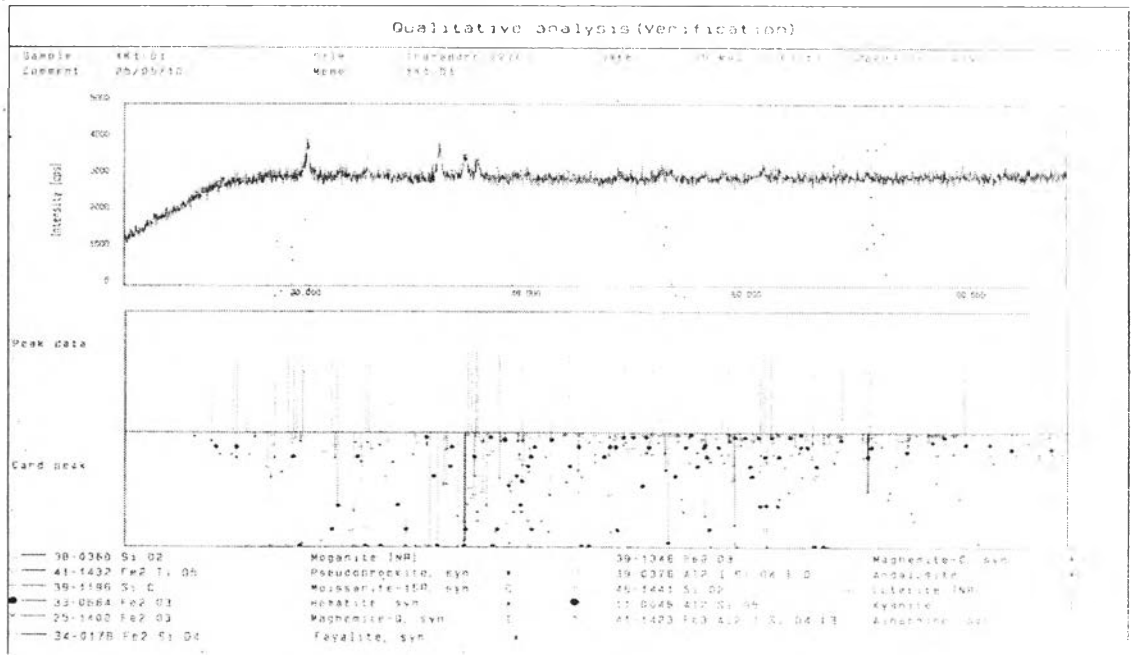


Figure E-11 XRD spectrum of XK-01 1st specimen.

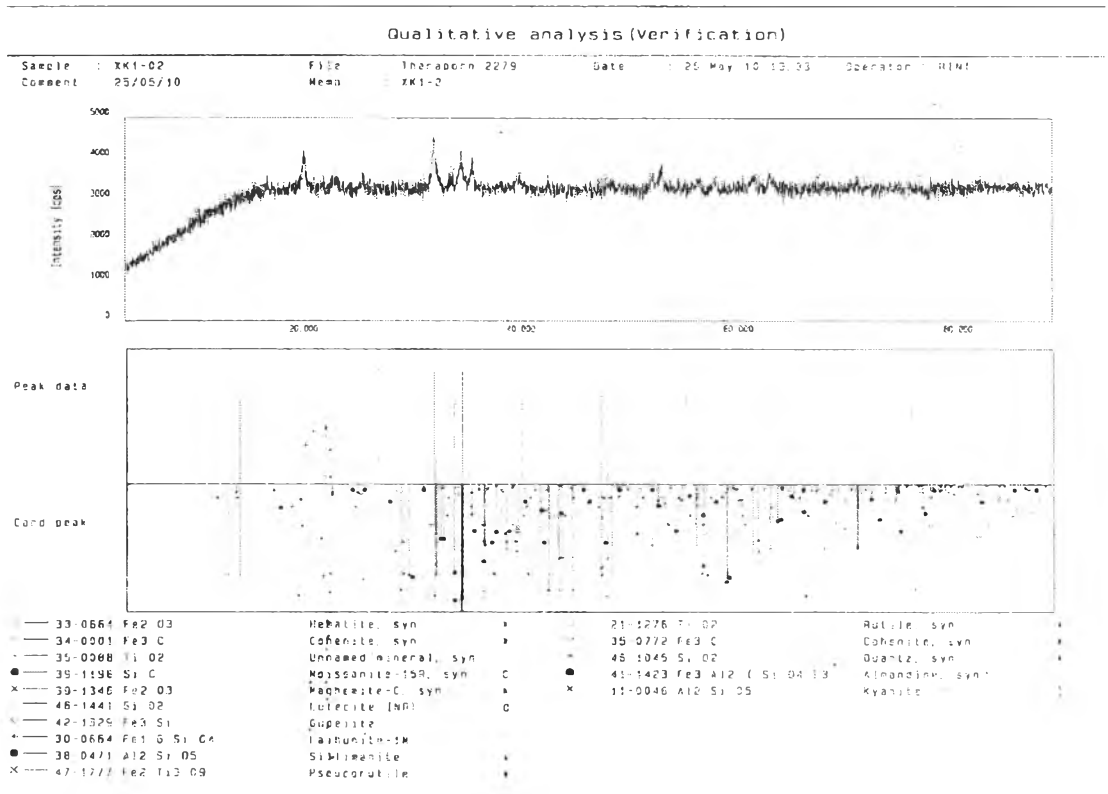


Figure E-12 XRD spectrum of XK-01 2nd specimen.

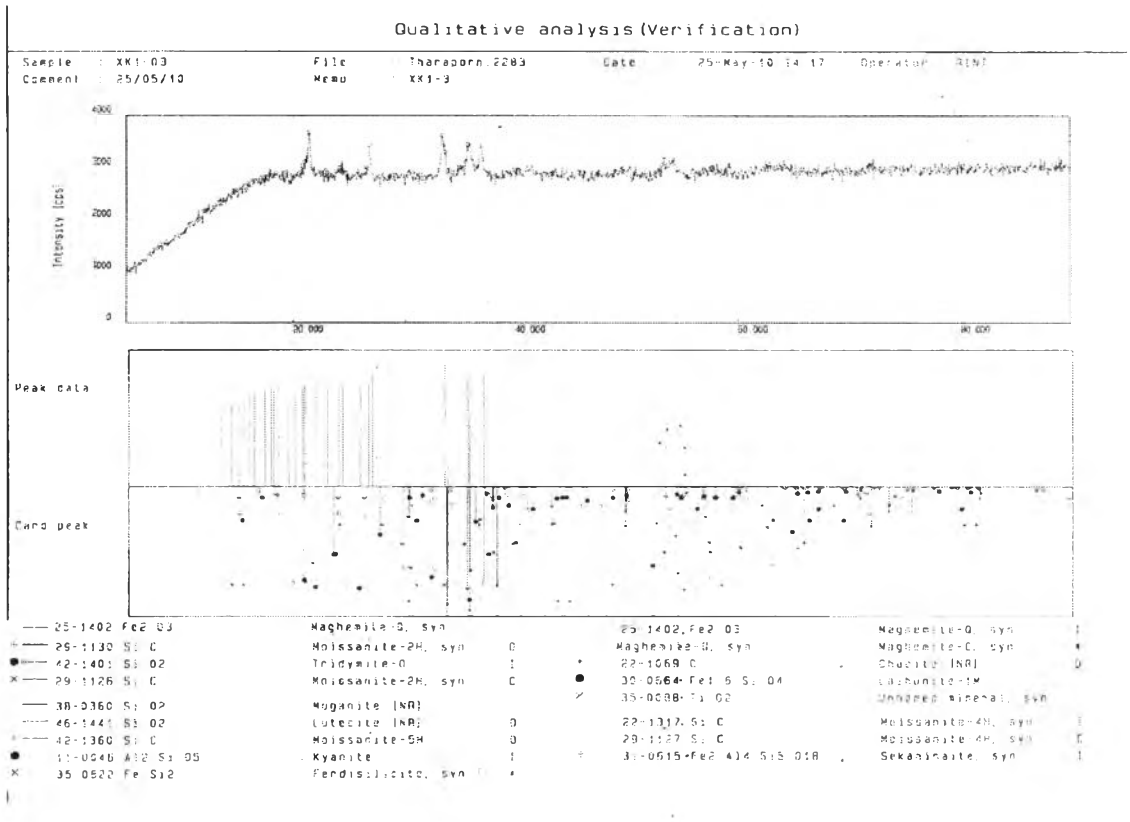


Figure E-13 XRD spectrum of XK-01 3rd specimen.

E.2.2 Dai coal

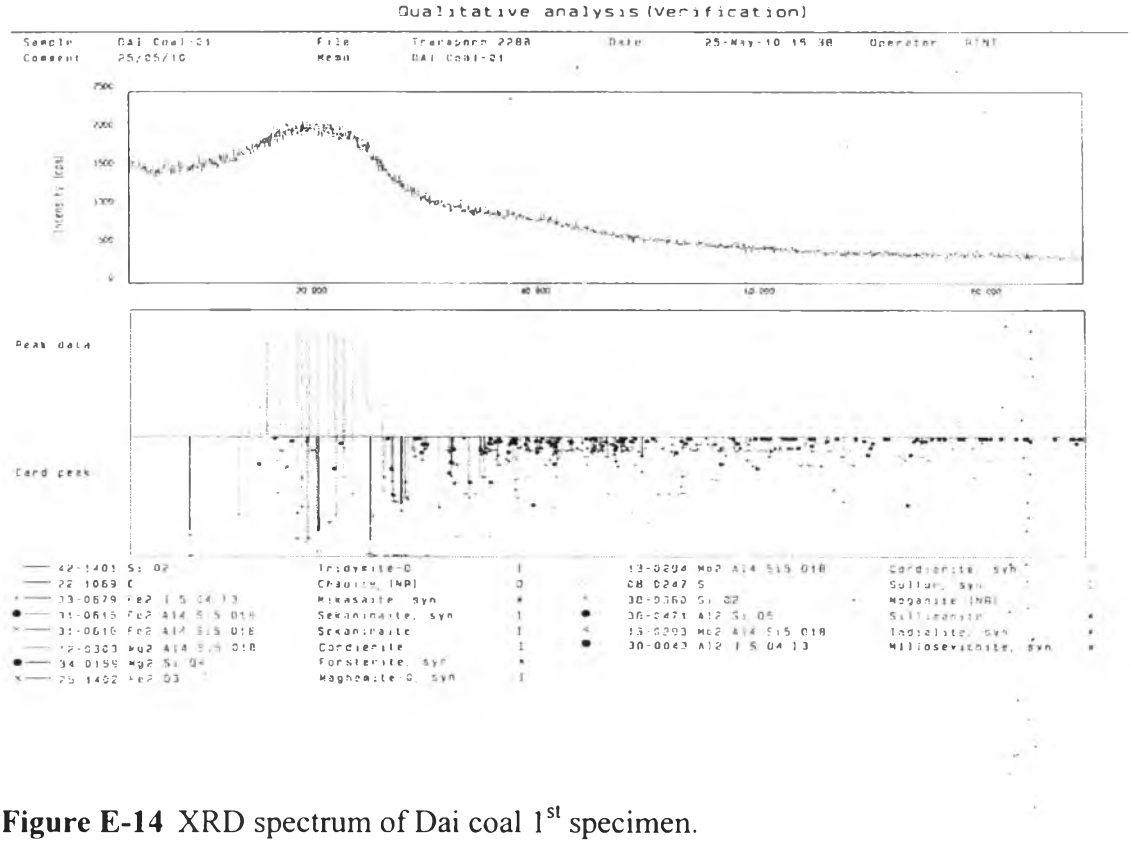


Figure E-14 XRD spectrum of Dai coal 1st specimen.

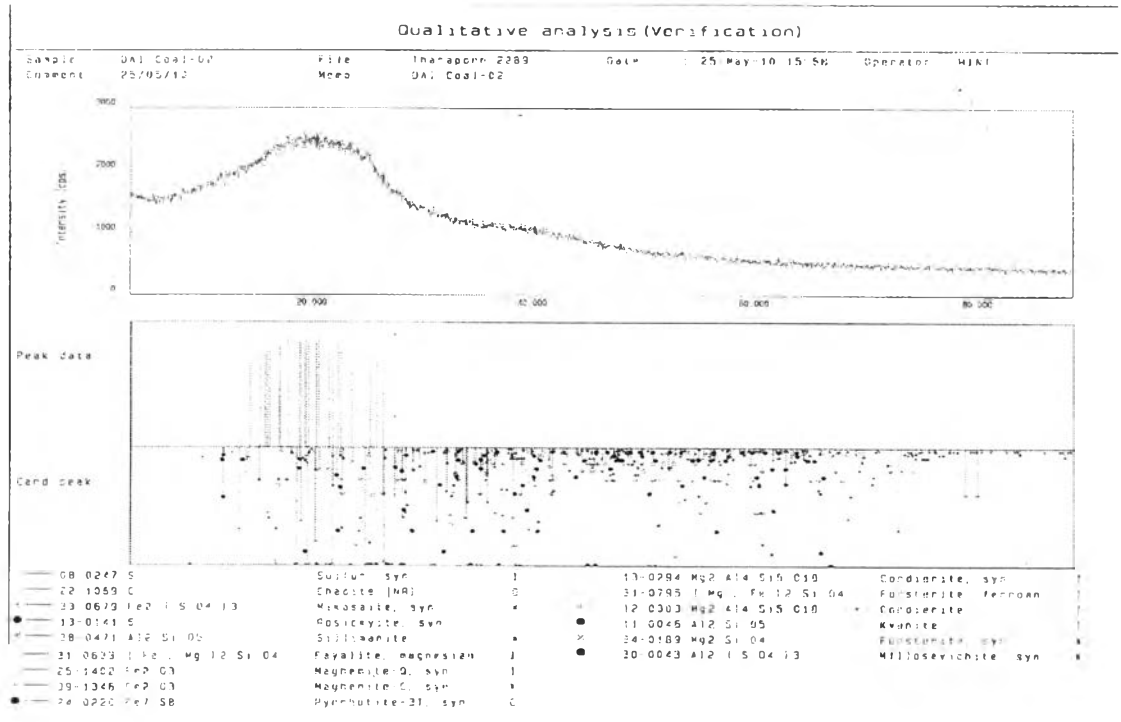


Figure E-15 XRD spectrum of Dai coal 2nd specimen.

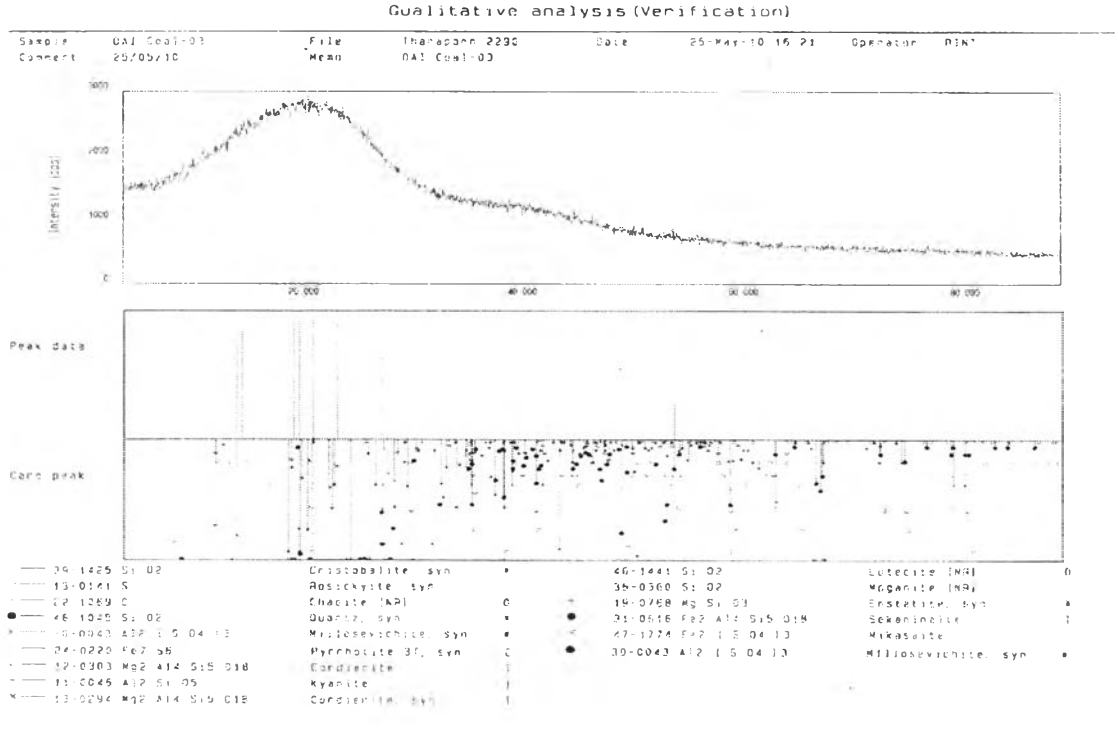


Figure E-16 XRD spectrum of Dai coal 3rd specimen.

E.2.3 Experiment 6,

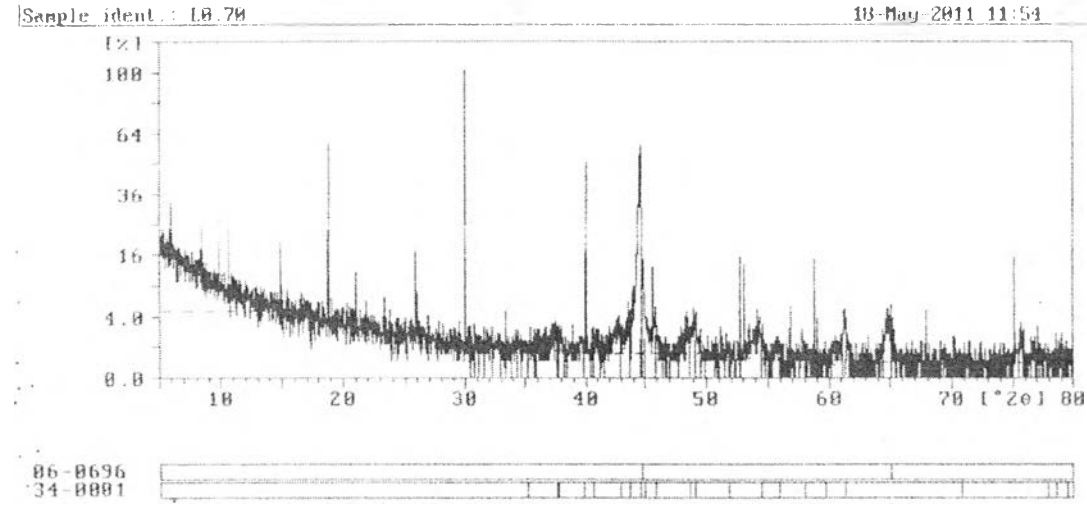


Figure E-17 XRD spectrum of Iron nugget, Experiment 6, No. 3.

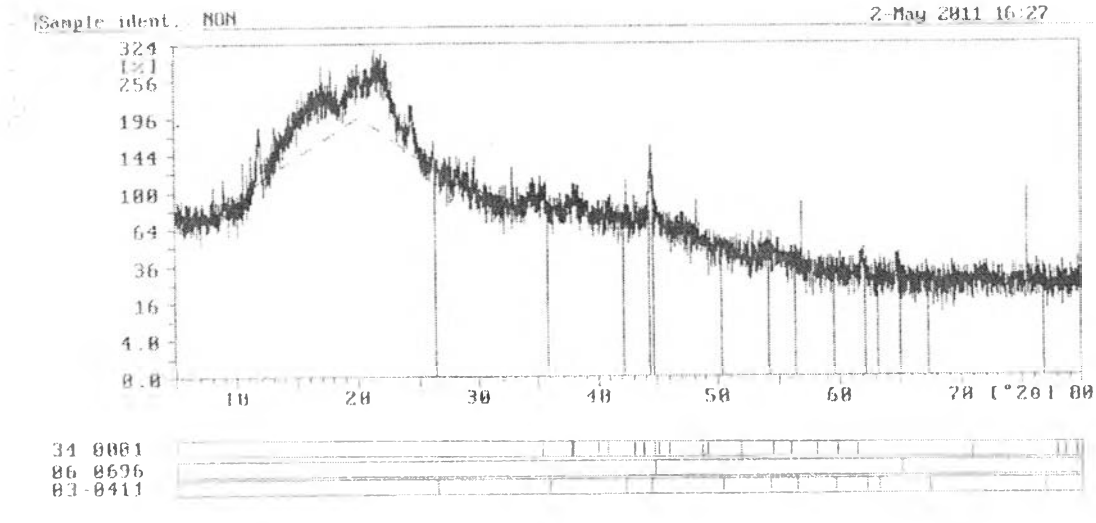


Figure E-18 XRD spectrum of Iron nugget, Experiment 6, No. 4.

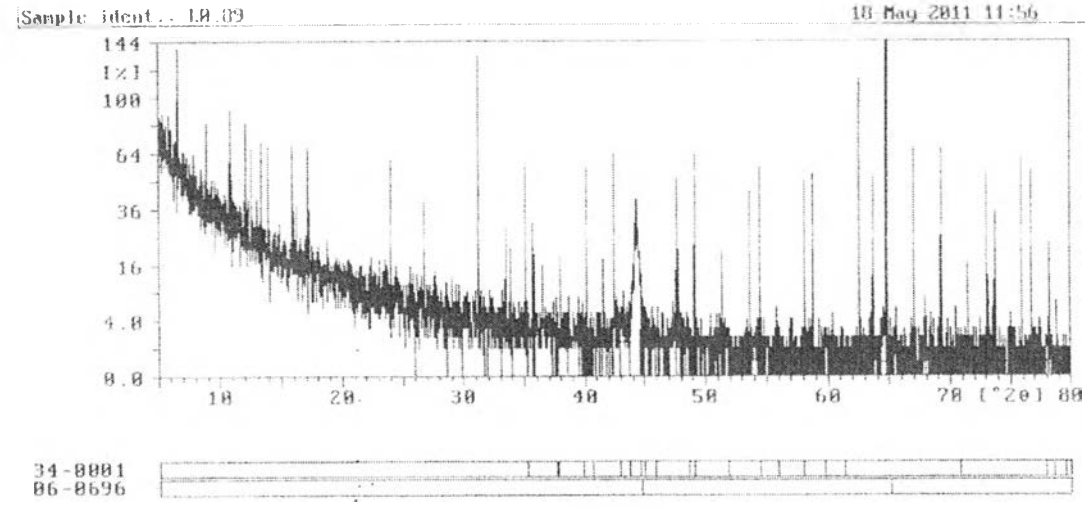


Figure E-19 XRD spectrum of Iron nugget, Experiment 6, No. 5.

E.2.4 Reference

The XRD reference data came from software X'Pert APD.

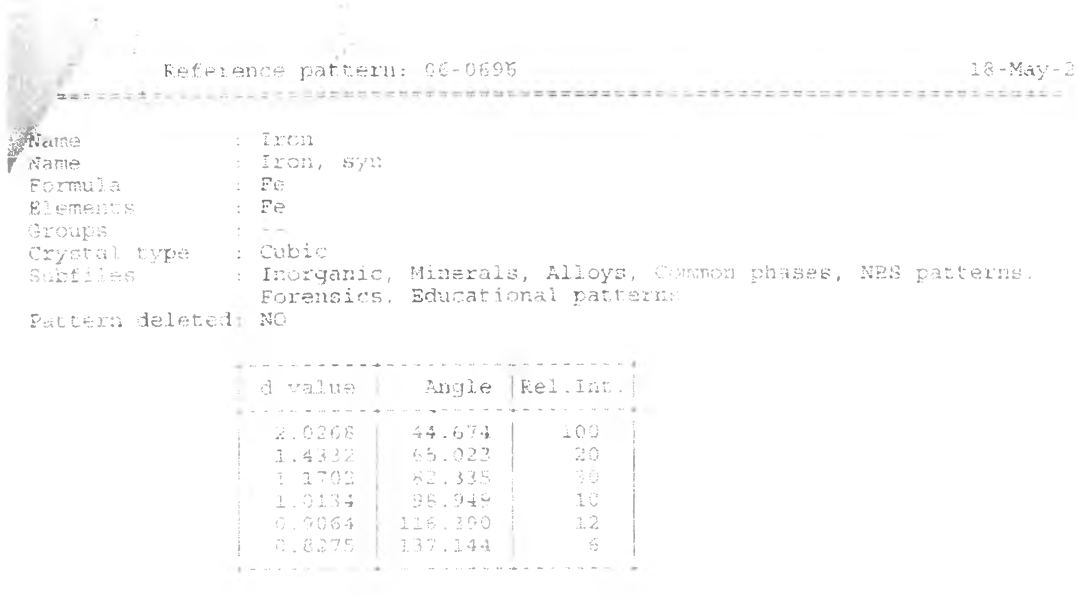
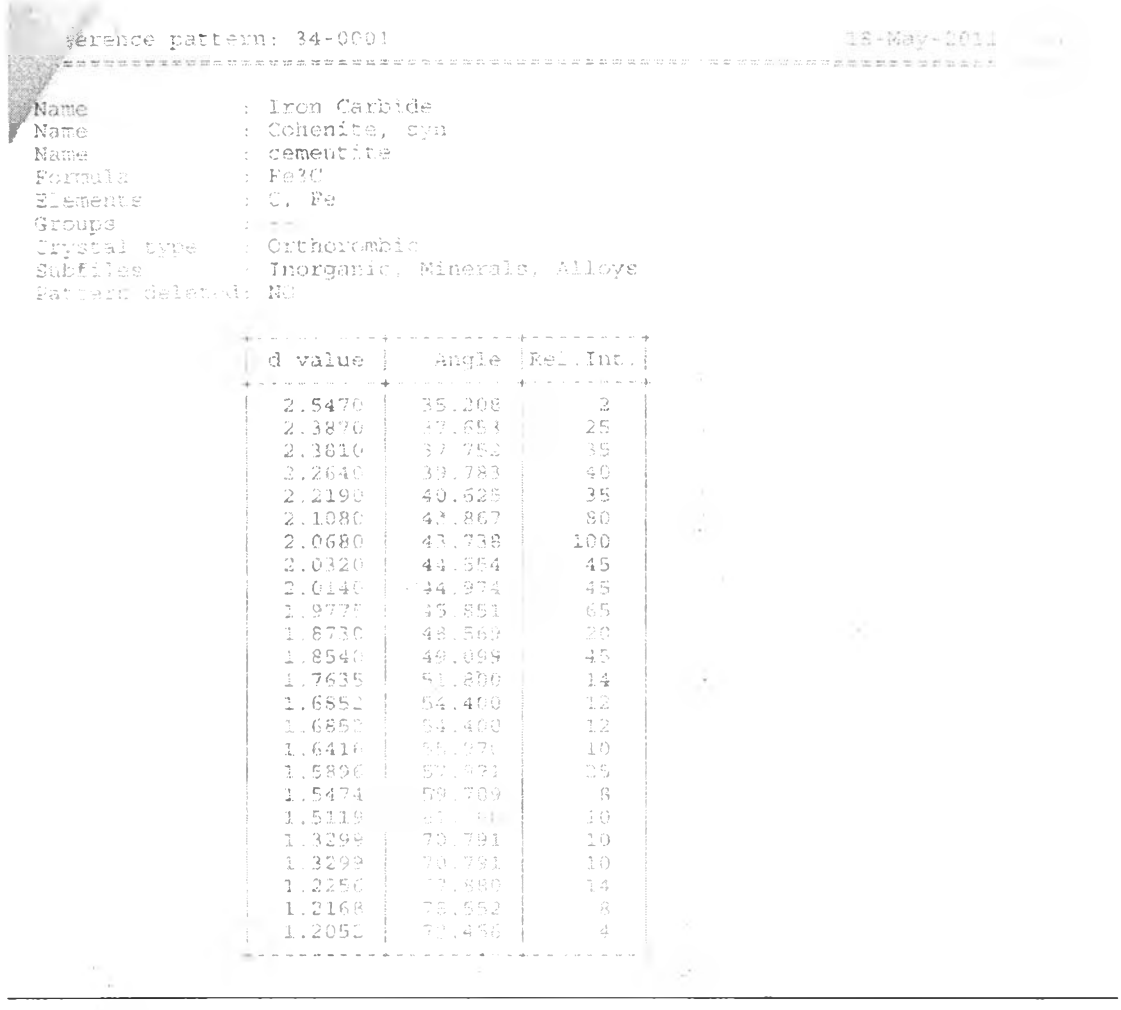


Figure E-20 XRD reference 06-0696 Iron.



ference pattern: 34-0001 16-May-2011

Name : Iron Carbide
Name : Cohenite, syn
Name : cementite
Formula : Fe3C
Elements : C, Fe
Groups : ---
Crystal type : Orthorombic
Subfiles : Inorganic, Minerals, Alloys
Pattern deleted: NO

d value	Angle	Rel.Int.
2.5470	35.208	2
2.3870	37.653	25
2.3810	37.752	35
2.2640	39.783	40
2.2190	40.625	35
2.1080	42.867	80
2.0680	43.738	100
2.0320	44.554	45
2.0140	44.974	45
1.9770	45.851	65
1.8730	48.569	20
1.8540	49.099	45
1.7635	51.800	14
1.6852	54.400	12
1.6852	54.400	12
1.6410	55.971	10
1.5896	57.921	25
1.5474	59.709	8
1.5119	61.341	10
1.3299	70.791	10
1.3299	70.791	10
1.2256	77.980	14
1.2168	78.552	8
1.2052	79.456	4

Figure E-21 XRD reference 34-0001 Iron carbide.

Reference pattern: 03-0411

Name : Iron Carbide
Name : A-ferrite
Formula : FeC
Elements : C, Fe
Groups :
Crystal type : Orthorombic
Subfiles : Inorganic, Alloys, Common phases
Pattern deleted: NO

d value	Angle	Rel.Int.
3.3700	26.426	100
2.5000	35.892	20
2.1400	42.195	40
2.0400	44.370	80
1.8100	50.375	20
1.6900	54.233	80
1.6300	56.403	10
1.5500	59.599	60
1.4900	62.260	20
1.4700	63.204	30
1.3900	67.307	40
1.2400	76.809	80
1.1800	81.506	10
1.1660	82.627	100
1.1170	87.189	60
1.0800	90.998	40

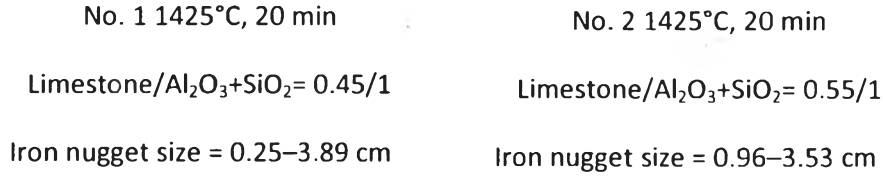
Figure E-22 XRD reference 03-0411 Iron carbide.

Appendix F: Experiment 7

Experiment 7 using the mol ratio of mixture C/Fe = 1.53 (the suitable mol ratio from Experiment 5.) and the mol ratio Limestone/Al_2O_3+SiO_2 of mixture was varied. All pellets were reduced at the reduction temperature 1425°C and the reduction time of 20 min. The weights of No. 1–3 after the reduction are shown in table F-1.

Table F-1 Experiment 7; the weight of No. 1–9 after the reduction through Mold A

No.	Reduction Temperature (°C)	Hold on reduction temperature (min)	Mol ratio Limestone/Al_2O_3+SiO_2	After Reduction (3 pellets) (g)	
				Iron nugget	Slag
1	1425	20	0.45		
2			0.55		
3			0.65		



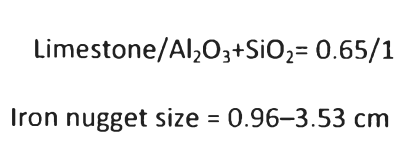


Figure F-1 Experiment 7: the pellets after the reduction.

Products from the reduction were characterized wt % Element by EDX; characterization result is shown in Appendix A-2. Table F-2 shows the % Element of No. 1-3 in the experiment 7. The % yield of No. 1–3 is shown in Table F-3.

Table F-2 Experiment 6 % wt Element of No. 1–3

Element	% wt Element of pellet						SD					
	1		2		3		1		2		3	
	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag	Iron nugget	Slag
C												
O												
Al												
Si												
K												
Fe												
Zr												
Mn												
Ca												
Ti												
Au												
Cu												
P												
S												
Mg												
Na												
Cl												

Table F-3 Experiment 7 % yield after reduction from Iron nuggets

No.	% wt Iron Ore in mixture	% wt Fe in mixture	Dried Weight of 3 pellets (g)	Fe In put (g)	% Fe Nugget from EDX	Iron nugget (g)	Fe Output (g)	% Yield	Separation status
1									
2									
3									

Table F-4 Experiment 7 density of Iron nuggets

No.	% Fe Nugget from EDX	Density (g/cm^3)	
		Average	SD
1			
2			
3			

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Proceeding:

1. Cheawchanpattanagone, L., Sirivat, A., and Siemanond, K. (2011, April 26). Processing of Iron nugget from low grade Iron ore. Proceedings of The 2nd Research Symposium on Petroleum, Petrochemicals, and Advanced Materials and The 17th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand