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Appendices

Appendix A

05-0602					Wavelength= 1.5405									
La2O3					2θ	Int.	h	k	l	2θ	Int.	h	k	l
Lanthanum Oxide					26.109*	34	1	0	0	130.547	2	1	0	7
					29.129*	31	0	0	2	131.649	1	4	0	1
					29.959*	100	1	0	1	136.844	2	2	2	4
					39.525*	58	1	0	2	146.207	1	3	1	4
					46.082*	63	1	1	0	148.296	2	2	1	6
Rad.: CuKα1 λ: 1.5405 Filter: Ni Beta'M d-sp:					52.130*	52	1	0	3					
Cut off: Int.: Diffract. I/Icor.:					53.713*	4	2	0	0					
Ref: Swanson, Fuyat, Natl. Bur. Stand. (U.S.), Circ. 539, III, 33 (1954)					55.437*	24	1	1	2					
					55.951*	17	2	0	1					
					60.367*	3	0	0	4					
					62.255*	5	2	0	2					
Sys.: Hexagonal S.G.: P3m1 (164)					66.867*	2	1	0	4					
a: 3.9373 b: c: 6.1299 A: C: 1.5569					72.091*	7	2	0	3					
α: β: γ: Z: 1 mp:					73.390*	2	2	1	0					
Ref: Ibid.					75.298*	12	2	1	1					
					79.151*	6	1	1	4					
					80.844*	4	2	1	2					
					83.761*	4	1	0	5					
Dx: 6.574 Dm: SS/FOM: I ₃₀ =47(0.160, 40)					85.047*	2	2	0	4					
					85.316*	4	3	0	0					
					89.916*	7	2	1	3					
Color: Colorless					92.555*	4	3	0	2					
Pattern taken at 26 C. Sample from Fairmount Chemical Company.					97.818*	<1	0	0	6					
Sample was annealed at 1200 C for one hour and mounted in petrolatum to prevent reabsorption of CO ₂ + H ₂ O. Spectroscopic analysis: <0.01% Ca, Mg, Si; <0.001% Al, Cu, Fe, Pb. Merck Index, 8th Ed., p. 608. Opaque mineral optical data on specimen from Nanseke, Uganda: R3R%=14.2, Disp.=Std., VHN100=782-813. Ref: IMA Commission on Ore Microscopy QDF. Pattern reviewed by Holzer, J., McCarthy, G., North Dakota State Univ., Fargo, ND, USA. ICDD Grant-In-Aid (1990. Validated by calculated pattern except for the following: 2.278 23 102; 1.968 28 110; 1.753 23 103. Calculated pattern indicates that the following reflections might be observable: 6.130 <1 001; 2.043 <1 003; 1.8744 <1 111; 1.4177 <1 113; 1.2260 <1 005. La ₂ O ₃ type. PSC: hP5. Mwt: 325.81. Volume[CD]: 82.30.					101.423	3	2	0	5					
					103.031	3	2	2	0					
					103.815	1	1	0	6					
					109.037	<1	3	1	0					
					110.543	3	2	2	2					
					111.023	5	3	1	1					
					115.035	2	3	0	4					
					116.256	2	1	1	6					
					120.248	5	2	1	5					
					122.967	1	2	0	6					
					127.640	4	3	1	3					

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36-1481					Wavelength= 1.5405981									
La(OH)3					2θ	Int.	h	k	l	2θ	Int.	h	k	l
Lanthanum Hydroxide					15.665*	59	1	0	0					
					27.309*	62	1	1	0					
					27.973	100	1	0	1					
					31.624*	16	2	0	0					
Rad.: CuKα1 λ: 1.5405 Filter: Graph Mono d-sp: Diffractometer					36.014*	8	1	1	1					
Cut off: 17.7 Int.: Diffract. I/Icor.:					39.478*	73	2	0	1					
Ref: McMurdie, H et al., Powder Diffraction, 1, 90 (1986)					42.268*	12	2	1	0					
					47.063*	13	0	0	2					
					48.265*	38	3	0	0					
					48.644*	61	2	1	1					
					49.891*	9	1	0	2					
Sys.: Hexagonal S.G.: P6 ₃ /m (176)					55.265*	21	1	1	2					
a: 6.5286(5) b: c: 3.8588(5) A: C: 0.5911					56.312*	10	2	2	0					
α: β: γ: Z: 2 mp:					57.822*	6	2	0	2					
Ref: Ibid.					58.866*	6	3	1	0					
					64.028*	15	3	1	1					
					65.096*	6	2	1	2					
					66.040*	3	4	0	0					
Dx: 4.428 Dm: SS/FOM ₂₇ =82(0.107, 31)					69.708*	14	3	0	2					
					70.948*	4	4	0	1					
					72.859*	2	3	2	0					
					75.800*	8	1	0	3					
					76.341*	9	2	2	2					
					77.279*	14	4	1	0					
					77.592*	14	3	2	1					
					78.522*	5	3	1	2					
					82.280*	5	2	0	3					
Color: Colorless														
Peak height intensity. The mean temperature of data collection was 24.7 C. CAS #: 14507-19-8. La ₂ O ₃ was heated with an excess of water and the mixture was refluxed for 4 days, filtered by suction and dried at 105 C for a few hours. See 6-386g(I ₀₀₁)=13. The structure was determined qualitatively by Zachariasen, W., Acta Crystallogr., 1 265 (1948). Tungsten used as an internal stand. PSC: hP14. Mwt: 189.93. Volume[CD]: 142.44.														

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05-0418		Wavelength= 1.5405									
SrCO ₃		2θ	Int	h	k	l	2θ	Int	h	k	l
Strontium Carbonate		20.318*	14	1	1	0	62.809*	6	2	2	3
		21.099*	6	0	2	0	63.702*	4	3	1	2
		25.171*	100	1	1	1	63.922*	9	3	3	0
Strontianite, syn		25.801*	70	0	2	1	65.218*	6	2	4	2
Rad.: CuKα1 λ: 1.5405 Filter: Ni Beta M d-sp:		29.613*	22	0	0	2	65.460*	7	1	1	4
Cut off: Int.: Diffract. I/Icor.:		31.259*	5	1	2	1	66.118*	5	1	5	2
Ref: Swanson, Fuyat, Natl. Bur. Stand. (U.S.), Circ. 539, III, 56 (1954)		31.496*	20	0	1	2	66.629*	4	0	6	0
		34.520*	12	1	0	2	72.008*	10	3	3	2
		35.106*	23	2	0	0	72.819*	4	2	0	4
		36.174*	34	1	1	2	73.723*	13	3	1	3
		36.524*	40	1	3	0	74.222*	4	4	0	0
Sys.: Orthorhombic S.G.: Pmcn (62)		36.631*	33	0	2	2					
a: 5.107 b: 8.414 c: 6.029 A: 0.6070 C: 0.7165		39.769*	5	2	1	1					
α: β: γ: Z: 4 mp:		41.320*	16	2	2	0					
Ref: Ibid.		42.960*	7	0	4	0					
		44.080*	50	2	2	1					
		45.640*	26	0	4	1					
		46.560*	21	2	0	2					
Dx: 3.785 Dm: 3.760 SS/FOM: I ₃₀ =140(.0051, 42)		47.690*	35	1	3	2					
		49.169*	3	1	4	1					
α: 1.517 η: 1.663 ε: 1.667 Sign: - 2V: 18°		49.920*	31	1	1	3					
Ref: Ibid.		50.270*	16	0	2	3					
		50.602*	4	2	3	1					
		51.639*	7	2	2	2					
		53.032*	5	0	4	2					
Color: Colorless		54.990*	3	3	1	0					
Pattern taken at 26 C. Sample from Mallinckrodt Chemical Works.		56.642*	4	2	4	0					
CAS #: 14941-40-3. Spectroscopic analysis: <0.1% Ba; 0.01% Ca.		57.242*	13	3	1	1					
Li: <0.001% Al, K, Mn, Na; <0.0001% Cu, Fe, Mg, Si. There is also a		57.629*	3	1	5	0					
rhombohedral form of SrCO ₃ stable above 912 C. Aragonite		58.860*	13	2	4	1					
group, aragonite subgroup. C.D. Cell: a=6.029, b=8.414,		59.820*	11	1	5	1					
c=5.107, a/b=0.7165, c/b=0.6070, S.G.=Pnam(62), PSC: oP20.		61.467*	3	0	0	4					
To replace 1-556 and 2-397. Mwt: 147.63. Volume[CD]: 259.07.											

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24-0508		Wavelength= 1.54056									
Mn ₂ O ₃		2θ	Int	h	k	l	2θ	Int	h	k	l
Manganese Oxide		18.841*	1	2	0	0	80.221*	<1	7	2	3
		23.119*	18	2	1	1	81.738*	1	8	0	0
		28.420*	<1	1	2	2	81.882*	1	0	0	8
Bixbyite-O, syn		32.920*	100	2	2	2	83.296*	1	5	5	4
Rad.: CuKα1 λ: 1.5405 Filter: d-sp: Calculated		35.659*	2	3	1	2	83.401*	1	4	1	7
Cut off: Int.: Calculated I/Icor.:		38.200*	11	4	0	0	84.840*	<1	8	2	0
Ref: Natl. Bur. Stand. (U.S.) Monogr. 25, 11, 95 (1973)		40.620*	<1	4	1	1	84.959*	<1	2	0	8
		42.921*	<1	4	0	2	86.404*	1	3	5	6
		45.141*	9	3	2	3	87.916*	<1	8	2	2
		47.279*	1	2	2	4	88.016*	<1	2	2	8
		49.319*	10	4	1	3	89.461*	<1	8	1	3
Sys.: Orthorhombic S.G.: Pcab (61)		53.240*	2	5	2	1	91.017*	2	2	6	6
a: 9.4161(3) b: 9.4237(3) c: 9.4051(3) A: 0.9992 C: 0.9980		55.139*	27	0	4	4					
α: β: γ: Z: 16 mp:		57.000*	2	3	3	4					
Ref: Geller, S., Acta Crystallogr., Sec. B, 27, 821 (1971)		58.821*	<1	4	2	4					
		60.580*	2	5	2	3					
		62.318*	<1	6	0	2					
		64.058*	4	1	4	5					
		65.722*	11	6	2	2					
Dx: 5.026 Dm: 4.960 SS/FOM: I ₃₀ =23(.0047, 284)		67.399*	3	6	3	1					
		69.060*	3	4	4	4					
		70.697*	<1	5	3	4					
Species originally called partridgeite. Published values: a=9.4157,		72.337*	<1	6	0	4					
b=9.4233, c=9.4047, for lambda=0.70926, (Geller, 1971). The pattern		73.901*	1	7	2	1					
was calculated using structure information from a synthetic		73.982*	1	1	2	7					
single-crystal. Bixbyite group, bixbyite subgroup. Also called:		75.478*	<1	2	6	4					
partridgeite. PSC: oP80. Mwt: 157.87. Volume[CD]: 834.56.											

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43-1003

Wavelength= 1.54056

Co ₃ O ₄		2 θ	Int	h	k	l
Cobalt Oxide						
		19.000*	16	1	1	1
		31.271*	33	2	2	0
		36.845*	100	3	1	1
		38.546*	9	2	2	2
		44.808*	20	4	0	0
Rad.: CuK α 1 λ : 1.5405 Filter: Mono d-sp: Calculated		49.081*	<1	3	3	1
Cut off: 15.0 Int.: Calculated I/Icor.: 4.30		55.655*	9	4	2	2
Ref: Grier, D., McCarthy, G., North Dakota State University, Fargo, North Dakota, USA. ICDD Grant-in-Aid, (1991)		59.353*	32	5	1	1
		65.231*	38	4	4	0
		68.628*	1	5	3	1
		69.741*	<1	4	4	2
Sys.: Cubic S.G.: Fd3m (227)		74.117*	3	6	2	0
a: 8.084	b:	c:	A:	C:		
					77.338*	8 5 3 3
					78.403*	4 6 2 2
α :	β :	γ :	Z: 8	mp:	82.625*	2 4 4 4
Ref: Ibid.					85.759*	1 5 5 1
					90.963*	4 6 4 2
					94.096*	11 7 3 1
Dx: 6.055	Dm:	SS/FOM: $I_{30}^2=317(.0032, 30)$			99.331*	4 8 0 0
					102.512	<1 7 3 3
					103.582	<1 6 4 4
					107.904	2 8 2 2
Peak height intensity. Calculation of diffractometer peak intensities done with MICRO-POWD v. 2.2 (D. Smith and K. Smith) using default instrument broadening function (NBS Table), diffracted beam monochromator polarization correction, and atomic scattering factors corrected for anomalous dispersion. Cell parameters from 9-418. Atomic positions from Roth, W., J. Phys. Chem. Solids, 25 1-10 (1964): Co(1) in 8a, Co(2) in 16d, O in 32e with x=.3881. Isotropic thermal parameters from same source: Co(1), Co(2), and O. B=.413. Al ₂ MgO ₄ type. PSC: cF56. Mwt: 240.80. Volume[CD]: 528.30.						
					111.208	7 7 5 1
					112.335	2 6 6 2
					116.919	3 8 4 0
					120.481	<1 9 1 1
					121.697	<1 8 4 2
					126.710	1 6 6 4
					130.733	6 9 3 1
					137.993	10 8 4 4

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33-0664

Wavelength= 1.540598

Fe ₂ O ₃		2 θ	Int	h	k	l	2 θ	Int	h	k	l
Iron Oxide											
		24.138*	30	0	1	2	125.929	1	2	3	8
		33.153*	100	1	0	4	128.758	3	4	0	10
		35.612*	70	1	1	0	131.877	5	1	2	14
Hematite, syn		39.277*	3	0	0	6	133.241	3	3	3	0
Rad.: CuK α 1 λ : 1.5405 Filter: Mono d-sp: Diffractometer		40.855*	20	1	1	3	144.456	4	3	2	10
Cut off: Int.: Diffract. I/Icor.: 2.4		43.519*	3	2	0	2	147.971	4	2	4	4
Ref: Natl. Bur. Stand. (U.S.) Monogr. 25, 18, 37 (1981)		49.480*	40	0	2	4					
		54.091*	45	1	1	6					
		56.152*	1	2	1	1					
		57.429*	5	1	2	2					
		57.590*	10	0	1	8					
Sys.: Rhombohedral S.G.: R $\bar{3}c$ (167)		62.451*	30	2	1	4					
a: 5.0356(1)	b:	c: 13.7489(7)	A:	C: 2.7303			63.991*	30	3	0	0
							66.028	<1	1	2	5
α :	β :	γ :	Z: 6	mp: 1350-1360			69.601*	3	2	0	8
Ref: Ibid.							71.937*	10	1	0	10
							72.262*	6	1	1	9
							75.430*	8	2	2	0
							77.729*	4	3	0	6
Dx: 5.270	Dm: 5.260	SS/FOM: $I_{30}^2=69(.0111, 39)$					78.760*	2	2	2	3
ϵ : 2.94	η : 3.22	$\epsilon\gamma$:	Sign: - 2V:				80.711*	5	1	2	8
							82.939*	5	0	2	10
Ref: Dana's System of Mineralogy, 7th Ed., I. 529 (1944)							84.916*	7	1	3	4
							88.542*	7	2	2	6
							91.345*	2	0	4	2
							93.715*	7	2	1	10
							95.239*	<1	1	1	12
							95.663*	3	4	0	4
							102.285	4	3	1	8
							104.914	<1	2	2	9
							106.623	5	3	2	4
							107.025	4	0	1	14
							108.090	5	4	1	0
							111.518	2	4	1	3
							113.594	2	0	4	8
							116.044	5	1	3	10
							117.758	1	3	0	12
							118.697	3	2	0	14
							122.431	6	4	1	6
Color: Dark reddish brown Pattern taken at 25 C. Sample from Pfizer, Inc., NY, USA. heated at 800 C for 3 days. CAS #: 1309-37-1. Opaque mineral optical data on specimen from Elba, R1R0=30.2, RR2Re=26.1, Disp.=16, VHN=1038 (mean at 100, 200, 300). Color values=.299, .309, 29.8, 2.299, .309, 25.7. Ref: IMA Commission on Ore Microscopy QDF. Pattern reviewed by Syvinski, W., McCarthy, G., North Dakota State Univ., Fargo, ND, USA. ICDD Grant-in-Aid (1990). Agress well with experimental and calculated patterns. Additional weak reflection [indicated by brackets] was observed. Also called: crocus mantis. Also called: venetian red. Also called: ferrite. Also called: indian red. Also called: crocus. Al ₂ O ₃ type. Corundum group, corundum subgroup. Also called: burnt ochre. Also called: rouge. Silver used as an internal stand. PSC: hR10. To replace 13-534 and validated by calculated pattern 24-72. Mwt: 159.69. Volume[CD]: 301.93.											

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40-1100 Wavelength= 1.5418

La _{0.8} Sr _{0.2} MnO ₃		2 θ	Int	h	k	l
Strontium Lanthanum Manganese Oxide						
		22.811*	13	1	1	0
		32.342*	67	0	2	0
		32.655*	100	2	0	0
		38.237*	1	1	2	1
		39.957*	19	0	2	2
Rad.: CuK α λ : 1.5418 Filter: Graph Mono d-sp: Diffractometer		40.466*	8	2	0	2
Cut off: Int.: Diffract. I/Icor.:		46.627*	47	2	2	0
Ref: Hashimoto, T et al., J. Cryst. Growth, 84, 207 (1987)		52.315*	4	1	3	0
		52.737*	5	2	2	2
		57.687*	14	1	3	2
		57.885*	21	1	3	2
Sys. Monoclinic S.G.: P2/c (13)		58.480*	17	3	1	2
a: 5.4843(1) b: 5.5349(1) c: 7.7916(3) A: 0.9909 C: 1.4077		67.715*	8	0	4	0
α : β : 90.746(2) γ : Z: 4 mp:		68.434*	15	4	0	0
Ref: Ibid.		72.488*	1	0	4	2
		72.838*	2	3	3	0
		73.529*	1	4	0	2
		77.219*	9	2	4	0
Dx: 6.504 Dm: SS/FOM: $\Gamma_1g=22(0064,134)$		77.734*	8	3	3	2

C.D. Cell: a=7.792, b=5.535, c=5.484, β =90.75.
a/b=1.4077, c/b=0.9909, S.G.=P2/a(13). PSC: mP20. Mwt:
231.58. Volume[CD]: 236.49.

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35-1480 Wavelength= 1.5418

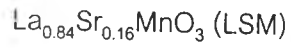
(La _{0.8} Sr _{0.2})FeO ₃		2 θ	Int	h	k	l	2 θ	Int	h	k	l	
Strontium Iron Lanthanum Oxide												
		22.619*	10	1	1	0	94.714*	17	2	4	4	
		22.619*	10	0	0	2	94.714*	17	1	3	6	
		25.360*	<1	1	1	1	103.893	2	4	4	0	
		32.258*	100	0	2	0	103.893	2	0	0	8	
		32.258*	100	1	1	2	113.276	10	5	3	2	
Rad.: CuK α λ : 1.5418 Filter: Beta d-sp: Diffractometer		34.305*	<1	0	2	1	113.276	10	2	0	8	
Cut off: Int.: Diffract. I/Icor.:		37.998*	1	1	0	3						
Ref: Taguchi, H., Osaka Prefectural Ind. Res. Inst., Osaka, Japan, Private Communication, (1984)		37.998*	1	2	1	1						
		39.797*	16	0	2	2						
		41.498*	<1	1	1	3						
		46.322*	30	2	2	0						
Sys.: Orthorhombic S.G.: Pbn* (62)		46.322*	30	0	0	4						
a: 5.532 b: 5.553 c: 7.835 A: 0.9962 C: 1.4109		52.145*	5	1	1	4						
α : β : γ : Z: mp:		53.525*	1	1	3	1						
Ref: Ibid.		57.608*	40	0	2	4						
		57.608*	40	2	0	4						
		63.889*	<1	1	3	3						
		67.643*	15	2	2	4						
Dx: Dm: SS/FOM: $\Gamma_2g=3(.044,173)$		72.289*	2	1	3	4						
		72.289*	2	3	3	0						
		76.953*	13	3	3	2						
		76.953*	13	1	1	6						
Sample was prepared at 1300 C for 24 hours in a flow of pure oxygen gas. C.D. Cell: a=5.553, b=7.835, c=5.532, a/b=0.7087, c/b=0.7061, S.G.=Pn*a. Silicon used as an external stand. PSC: oP?. Mwt: 232.49. Volume[CD]: 240.68.		81.332*	2	2	4	2						
		81.332*	2	0	2	6						
		85.751*	4	0	4	4						

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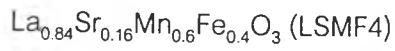
27-1402		Wavelength= 1.5405981			
SI	2 θ	Int	h	k	l
Silicon	28.443	100	1	1	1
	47.304	55	2	2	0
	56.122	30	3	1	1
Silicon, syn	69.132	6	4	0	0
	76.379	11	3	3	1
Rad.: CuK α λ : 1.5405 Filter: Mono d-sp: Diffractometer	88.029	12	4	2	2
Cut off: Int.: Diffact. I/Icon.: 4.70	94.951	6	5	1	1
Ref: Natl. Bur. Stand. (U.S.) Monogr. 25, 13, 35 (1976)	106.719	3	4	4	0
	114.092	7	5	3	1
	127.547	8	6	2	0
	136.897	3	5	3	3
Sym.: Cubic	S.G.: Fd3m (227)				
a: 5.43088(4) b:	a:	A:	C:		
c:	β :	γ :	Z: 8	imp:	
Ref: Ibid.					
DR: 2.329 Dm: SS/POM ₁ -409(.0021, 13)					
Color: Gray					
Pattern taken at 25(1) C. This sample is NBS Standard Reference Material No. 640, CAS #: 7440-21-3.					
Reflections calculated from precision measurement of a_0 .					
a_0 uncorrected for refraction, C type, Diamond group.					
Tungsten used as an internal stand. PSC: cF8. To replace 5-563 and 26-1481. Mwt: 28.09. Volume[CD]: 160.18.					

Appendix B

XRD data of calcined powder mixed with Si



No	2-theta	d-value	INT.	I/Io
1	22.820	3.89368	1132	35
2	28.440	3.13574	685	21
3	32.380	2.76261	3220	100
4	32.660	2.73956	3104	96
5	38.240	2.35166	428	13
6	40.000	2.25215	1081	34
7	40.520	2.22444	521	16
8	46.620	1.94660	1688	52
9	52.360	1.74591	486	15
10	52.780	1.73300	487	15
11	57.920	1.59084	1420	44
12	58.540	1.57546	710	22
13	67.860	1.37999	607	19
14	68.480	1.36900	680	21
15	69.140	1.35753	741	23
16	72.940	1.29589	420	13
17	77.220	1.23439	537	17
18	77.800	1.22663	621	19
19	82.120	1.17269	405	13
20	86.360	1.12566	472	15



No	2-theta	d-value	INT.	I/Io
1	22.800	3.89705	1039	31
2	28.420	3.13790	757	23
3	32.420	2.75929	3311	100
4	38.280	2.34929	495	15
5	39.960	2.25431	1041	31
6	40.500	2.22549	534	16
7	46.580	1.94818	1625	49
8	47.380	1.91713	629	19
9	52.340	1.74653	610	18
10	57.840	1.59285	1310	40
11	58.480	1.57693	627	19
12	67.780	1.38142	580	18
13	68.400	1.37040	548	17
14	72.740	1.29896	492	15
15	77.360	1.23251	627	19
16	81.780	1.17670	484	15
17	86.160	1.12776	505	15

Biography



Miss. Tanawadee Dechakupt was born on the 27th of April in 1976. She was born in Yala. After graduating with a Bachelor Degree in Materials Science from Faculty of Science, Chulalongkorn University in 1997, she worked in R&D division of Minebea Thai company for 1 year. She continued a further study in Master Degree in the field of Ceramic Technology at Chulalongkorn University in 1998 and graduated in October 2000.