

REFERENCES

1. World production, consumption and stock of rice, available from:
[http://www.bot.or.th/bothompage/library/print2.asp\[2004\]](http://www.bot.or.th/bothompage/library/print2.asp[2004]), March, 30 2004.
2. โครงการส่งเสริมผู้ผลิตไฟฟ้ารายเล็กที่ใช้พลังงานหมุนเวียน ครั้งที่2, available from
<http://www.eppo.go.th/encon/encon-spp-renewb2.html>, March, 30 2004
3. Lanning, F.C., Silicon in rice, *J. Agric. Food Chem.* 11 (5) (1963): 435–437.
4. Boateng, A.A. and Skeete, D.A. Incineration of rice hull for use as a cementitious materials. *Cement & Concrete research.* 20 (1990): 795-802.
5. Ajiwe, V.I.E., et al. A preliminary study of cement from rice husk ash. *Bioresource Technology.* 73 (2000): 37-39.
6. Riveros and Garza, C. Rice husks as a source of high purity silica. *J. Crys. Growth.* 75 (1986): 126-131.
7. Della, V.P. et al. Rice husk as an alternate source for active silica production. *Materials Letters.* 57 (2002): 818-821.
8. Prasad, C.S. et al. Effect rice husk ash in whiteware compositions. *Ceram. Int.* 27(2001): 629-635.
9. Prasad, C.S. et al. Effect of substitution of quartz by rice husk ash and silica fume on the properties of whiteware compositions. *Ceram. Int.* (2002).
10. Worrall, W.E. *Clays and ceramic raw materials.* London and New York : Elsevier applied science publishers, (1986).
11. Norton, F.H. *Refractories.* New York : McGraw-Hill, (1968).
12. Brownell, W.E. *Structural clay products.* New York : Springer-Verlag, (1976).
13. Norton, F.H. *Ceramics for the artist potter.* London : Addison-Wesley Publishing Company, (1956).
14. Rahman, M. A. Properties of clay-sand-rice husk ash mixed bricks. *The International Journal of Cement Composites and Lightweight Concrete.* 9 (1987): 105-108.
15. Yogananda, M. R. and Jagadishi, K. S. Pozzolanic properties of rice husk ash, burnt clay and red mud. *Building and Environment.* 23 (1988): 303-308.

16. Cisse, I.K. and Laquerbe, M. Mechanical characterisation of filler sandcretes with rice husk ash additions study applied to Senegal. Cement and Concrete Research. 30 (2000): 13–18.
17. Veera Amnouyporn. Influence of rice husk ash on mechanical properties of clay brick. Master thesis. Department of Civil Engineering. Faculty of Engineering. Rungsit University. (1999).
18. American Society for Testing and Materials (ASTM). Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. ASTM D4318-00. New York : ASTM, (2003).
19. American Society for Testing and Materials (ASTM). Standard Test Methods for Drying and Firing Shrinkages of Ceramic Whiteware Clays. ASTM C326-82. New York : ASTM, (1997).
20. American Society for Testing and Materials (ASTM). Standard Test Methods for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products. ASTM C373-88. New York : ASTM, (1999).
21. American Society for Testing and Materials (ASTM). Standard Test Methods for Flexural Properties of Ceramic Whiteware Materials. ASTM C674-88. New York : ASTM, (1999).
22. Ibrahim, D.M. et al. Study of rice husk ash silica by infrared spectroscopy. Thermochemica Acta. 37 (1980) : 307-314.
23. James, J. and Subba, M. Rao. Silica from rice husk through thermal decomposition. Thermochemica Acta. 97 (1986) : 329-336.
24. Lawrence, W. G. and West, R. R. Ceramic science for the potter. Chilton Book Company, Pennsylvania, (1982).



APPENDICES

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Appendix A

Table A-1 Experimental data of plasticity of pure clay (PC)

Formula	PC				
Container #	1	2	3	4	5
No. of Blows	53	43	30	23	13
Container Wt. (g)	4.43	4.95	4.09	4.38	4.87
Wet Wt + Container (g)	10.93	11.19	10.60	11.25	12.26
Dry Wt + Container (g)	9.66	9.09	8.27	8.69	8.54
Wt of Water (g)	1.27	2.10	2.33	2.56	3.72
Dry Wt of Soil (g)	5.23	4.14	4.18	4.31	3.67
Water Content (%)	24.28	50.72	55.74	59.40	101.36

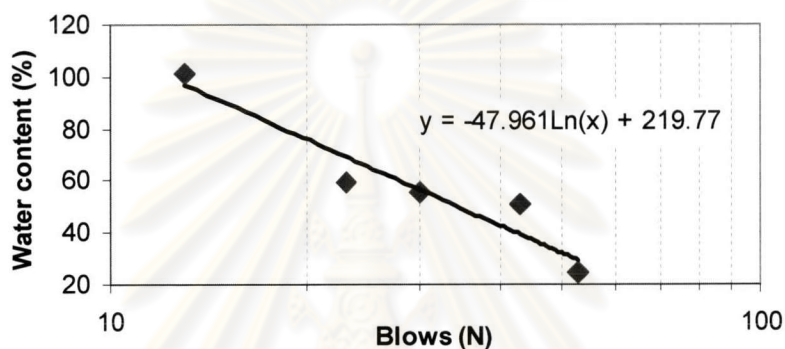


Table A-2 Experimental data of plasticity of normal formula (NF)

Formula	NF				
Container #	1	2	3	4	5
No. of Blows	41.00	32.00	22.00	16.00	10.00
Container Wt. (g)	4.06	4.44	4.34	4.12	4.91
Wet Wt + Container (g)	11.00	11.10	11.26	11.10	11.61
Dry Wt + Container (g)	8.84	8.91	8.88	8.61	9.04
Wt of Water (g)	2.16	2.19	2.38	2.49	2.57
Dry Wt of Soil (g)	4.78	4.47	4.54	4.49	4.13
Water Content (%)	45.19	48.99	52.42	55.46	62.23

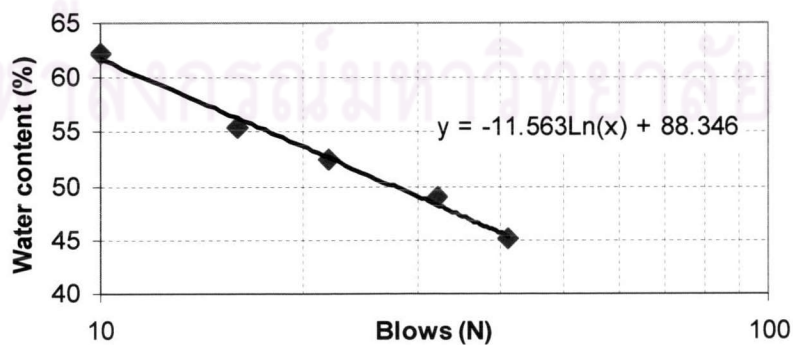


Table A-3 Experimental data of plasticity of NS50

Formula	NS50				
Container #	1	2	3	4	5
No. of Blows	42.00	33.00	23.00	14.00	8.00
Container Wt. (g)	6.51	1.66	1.82	1.90	1.53
Wet Wt + Container (g)	11.99	7.32	6.47	6.11	6.34
Dry Wt + Container (g)	10.17	5.38	4.79	4.50	4.29
Wt of Water (g)	1.82	1.94	1.68	1.61	2.05
Dry Wt of Soil (g)	3.66	3.72	2.97	2.60	2.76
Water Content (%)	49.73	52.15	56.57	61.92	74.28

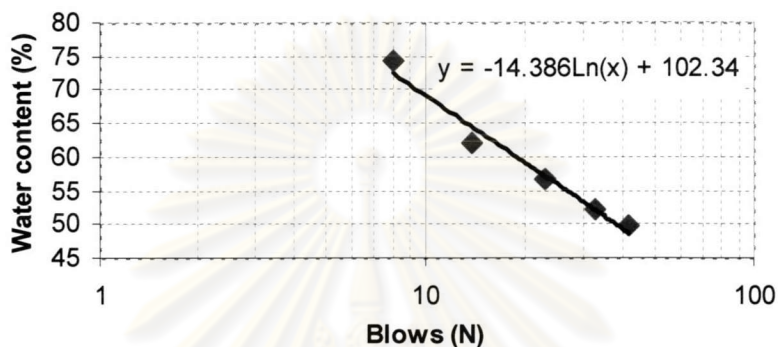


Table A-4 Experimental data of plasticity of NS100

Formula	NS100				
Container #	1	2	3	4	5
No. of Blows	51	41	37	26	13
Container Wt. (g)	4.94	4.96	4.24	4.22	4.38
Wet Wt + Container (g)	11.3	11.59	9.58	10.8	10.68
Dry Wt + Container (g)	9.29	9.44	7.79	8.52	8.33
Wt of Water (g)	2.01	2.15	1.79	2.28	2.35
Dry Wt of Soil (g)	4.35	4.48	3.55	4.3	3.95
Water Content (%)	46.21	47.99	50.42	53.02	59.49

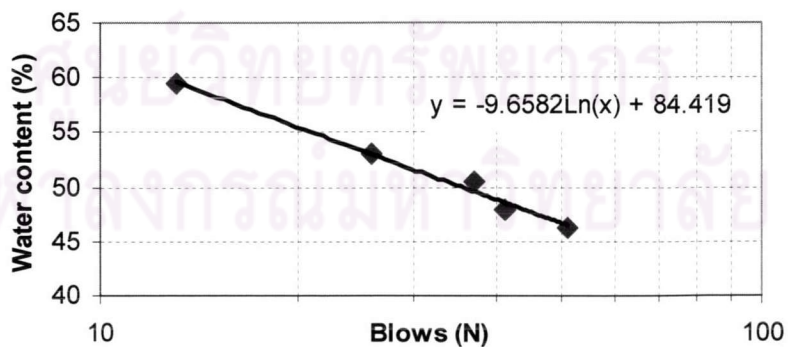


Table A-5 Experimental data of plasticity of 3RHA50

Formula	3RHA50				
Container #	1	2	3	4	5
No. of Blows	54	43	35	23	13
Container Wt. (g)	4.94	4.29	2.69	4.42	4.41
Wet Wt + Container (g)	10.68	9.75	8.87	9.01	10.48
Dry Wt + Container (g)	8.94	7.99	6.81	7.39	8.14
Wt of Water (g)	1.74	1.76	2.06	1.62	2.34
Dry Wt of Soil (g)	4.00	3.70	4.12	2.97	3.73
Water Content (%)	43.50	47.57	50.00	54.55	62.73

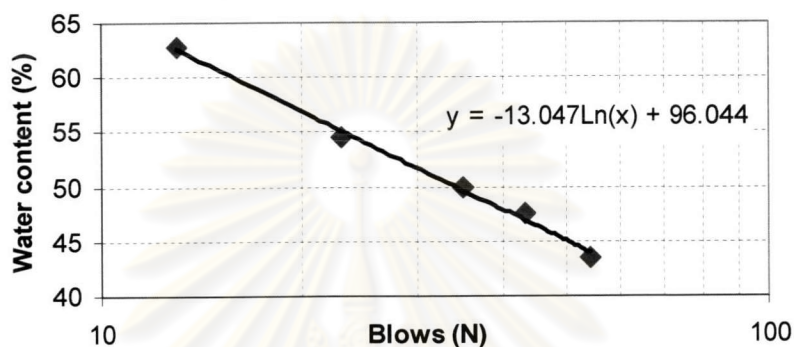


Table A-6 Experimental data of plasticity of 3RHA100

Formula	3RHA100				
Container #	1	2	3	4	5
No. of Blows	48	38	28	19	11
Container Wt. (g)	1.59	5.16	4.21	4.41	4.96
Wet Wt + Container (g)	6.57	10.09	9.06	8.86	10.15
Dry Wt + Container (g)	5.03	8.5	7.43	7.27	8.16
Wt of Water (g)	1.54	1.59	1.63	1.59	1.99
Dry Wt of Soil (g)	3.44	3.34	3.22	2.86	3.20
Water Content (%)	44.77	47.60	50.62	55.59	62.19

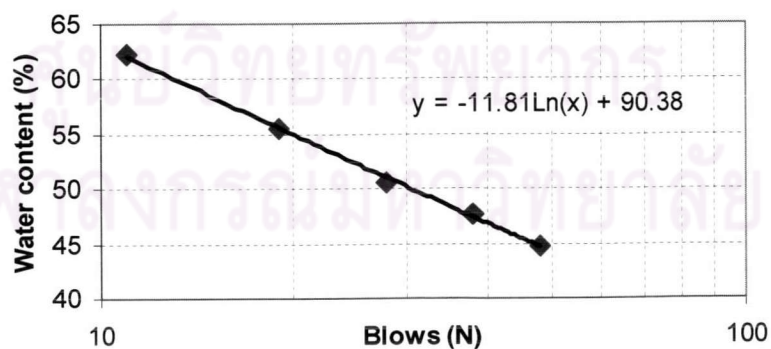


Table A-7 Experimental data of plasticity of 6RHA50

Formula	6RHA50				
Container #	1	2	3	4	5
No. of Blows	45	33	24	18	10
Container Wt. (g)	4.46	4.39	1.54	1.73	1.87
Wet Wt + Container (g)	9.40	9.59	6.88	7.30	6.98
Dry Wt + Container (g)	7.84	7.92	5.05	5.30	4.94
Wt of Water (g)	1.56	1.67	1.83	2.00	2.04
Dry Wt of Soil (g)	3.38	3.53	3.51	3.57	3.07
Water Content (%)	46.15	47.31	52.14	56.02	66.45

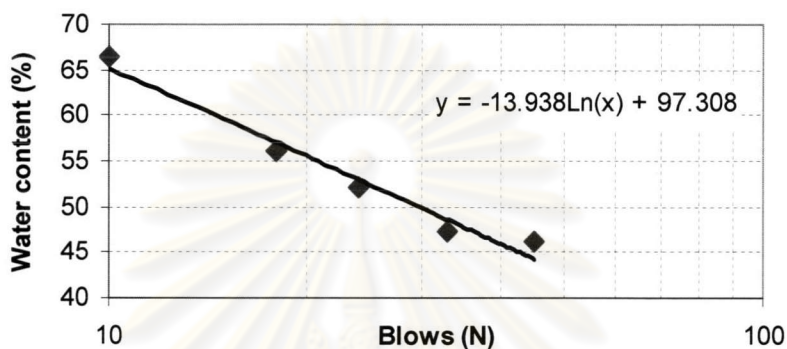


Table A-8 Experimental data of plasticity of 6RHA100

Formula	6RHA100				
Container #	1	2	3	4	5
No. of Blows	48	31	27	19	12
Container Wt. (g)	2.70	4.45	1.90	4.10	1.65
Wet Wt + Container (g)	8.69	10.85	8.36	10.17	7.45
Dry Wt + Container (g)	6.84	8.83	6.25	8.08	5.25
Wt of Water (g)	1.85	2.02	2.11	2.09	2.20
Dry Wt of Soil (g)	4.14	4.38	4.35	3.98	3.60
Water Content (%)	44.69	46.12	48.51	52.51	61.11

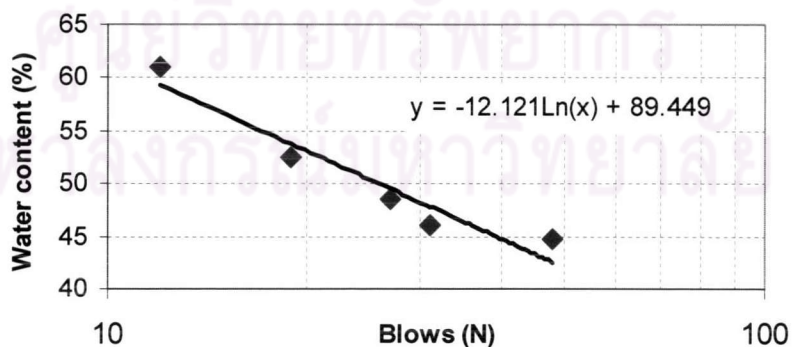


Table A-9 Experimental data of plasticity of 9RHA50

Formula	9RHA50				
Container #	1	2	3	4	5
No. of Blows	52	44	34	25	17
Container Wt. (g)	4.35	4.41	4.37	4.92	6.50
Wet Wt + Container (g)	9.08	10.09	9.20	10.67	11.77
Dry Wt + Container (g)	7.63	8.29	7.64	8.74	9.88
Wt of Water (g)	1.45	1.80	1.56	1.93	1.89
Dry Wt of Soil (g)	3.28	3.88	3.27	3.82	3.38
Water Content (%)	44.21	46.39	47.71	50.52	55.92

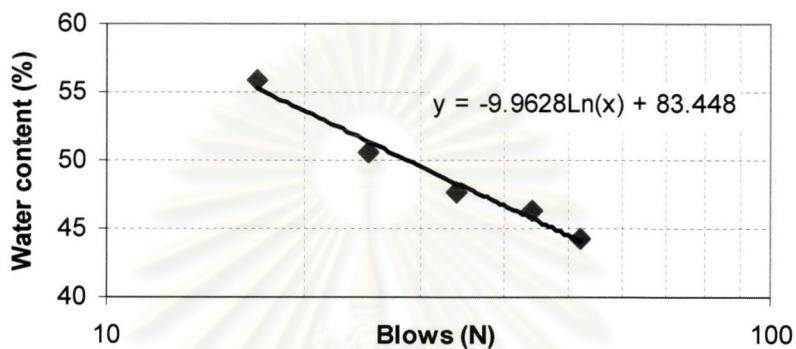
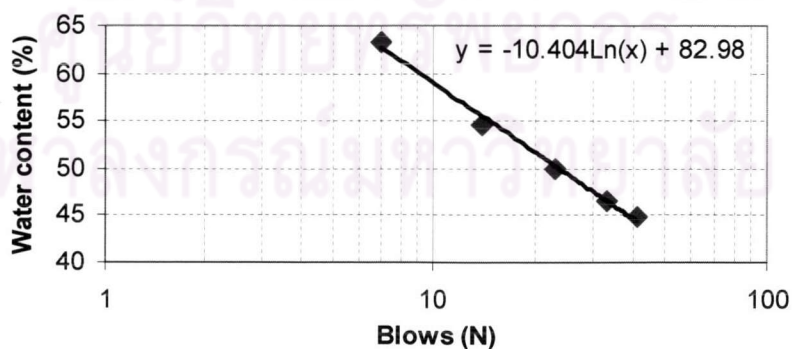


Table A-10 Experimental data of plasticity of 9RHA100

Formula	9RHA100				
Container #	1	2	3	4	5
No. of Blows	41	33	23	14	7
Container Wt. (g)	4.06	4.95	4.95	4.42	4.27
Wet Wt + Container (g)	9.22	10.45	10.18	10.81	10.07
Dry Wt + Container (g)	7.62	8.70	8.44	8.55	7.82
Wt of Water (g)	1.60	1.75	1.74	2.26	2.25
Dry Wt of Soil (g)	3.56	3.75	3.49	4.13	3.55
Water Content (%)	44.94	46.67	49.86	54.72	63.38



Appendix B

Table B-1 Experimental data of firing shrinkage of fired bodies at 900 °C

900 °C						
Formula	Specimen #	Length before firing	Length after fired	Linear firing shrinkage (%)	Avg. (%)	S.D.
		(cm)	(cm)			
NC	1	11.11	10.97	1.26	1.07	0.21
	2	11.27	11.14	1.15		
	3	11.12	11.01	0.99		
	4	11.28	11.13	1.33		
	5	11.24	11.10	1.25		
	6	11.21	11.08	1.16		
	7	11.14	11.01	1.17		
	8	11.14	11.04	0.90		
	9	11.23	11.15	0.71		
	10	11.05	10.96	0.81		
NF	1	11.17	11.07	0.90	0.90	0.15
	2	11.16	11.09	0.63		
	3	11.20	11.10	0.89		
	4	11.13	11.04	0.81		
	5	11.17	11.05	1.07		
	6	11.17	11.05	1.07		
	7	11.18	11.09	0.81		
	8	11.14	11.05	0.81		
	9	11.23	11.13	0.89		
	10	11.04	10.92	1.09		
NS50	1	11.46	11.36	0.87	0.98	0.11
	2	11.41	11.31	0.88		
	3	11.42	11.33	0.79		
	4	11.49	11.36	1.13		
	5	11.48	11.37	0.96		
	6	11.32	11.21	0.97		
	7	11.48	11.36	1.05		
	8	11.37	11.25	1.06		
	9	11.26	11.14	1.07		
	10	11.34	11.22	1.06		
NS100	1	11.46	11.35	0.96	1.05	0.30
	2	11.27	11.16	0.98		
	3	11.40	11.26	1.23		
	4	11.50	11.39	0.96		
	5	11.36	11.23	1.14		
	6	11.34	11.26	0.71		
	7	11.52	11.42	0.87		
	8	11.31	11.17	1.24		
	9	11.33	11.25	0.71		
	10	11.09	10.90	1.71		
3RHA50	1	11.04	10.94	0.91	0.89	0.15
	2	11.09	10.98	0.99		
	3	11.13	11.01	1.08		
	4	11.09	11.00	0.81		
	5	11.23	11.13	0.89		
	6	11.16	11.06	0.90		
	7	11.16	11.07	0.81		
	8	11.12	11.06	0.54		
	9	11.20	11.09	0.98		
	10	11.21	11.10	0.98		

900 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage (%)	Avg. (%)	S.D.
3RHA100	1	11.27	11.18	0.80	0.87	0.20
	2	11.40	11.30	0.88		
	3	11.38	11.26	1.05		
	4	11.28	11.15	1.15		
	5	11.27	11.17	0.89		
	6	11.21	11.10	0.98		
	7	11.22	11.13	0.80		
	8	11.16	11.11	0.45		
	9	11.27	11.19	0.71		
	10	11.35	11.24	0.97		
6RHA50	1	11.54	11.43	0.95	0.74	0.26
	2	11.31	11.23	0.71		
	3	11.45	11.35	0.87		
	4	11.27	11.17	0.89		
	5	11.46	11.39	0.61		
	6	11.32	11.23	0.80		
	7	11.47	11.36	0.96		
	8	11.28	11.18	0.89		
	9	11.42	11.35	0.61		
	10	11.36	11.35	0.09		
6RHA100	1	11.33	11.21	1.06	0.97	0.14
	2	11.34	11.24	0.88		
	3	11.26	11.12	1.24		
	4	11.27	11.18	0.80		
	5	11.32	11.21	0.97		
	6	11.41	11.29	1.05		
	7	11.52	11.41	0.95		
	8	11.19	11.10	0.80		
	9	11.38	11.26	1.05		
	10	11.44	11.34	0.87		
9RHA50	1	11.44	11.36	0.70	0.70	0.15
	2	11.48	11.42	0.52		
	3	11.31	11.22	0.80		
	4	11.29	11.21	0.71		
	5	11.27	11.19	0.71		
	6	11.21	11.12	0.80		
	7	11.42	11.38	0.35		
	8	11.28	11.19	0.80		
	9	11.12	11.03	0.81		
	10	11.25	11.16	0.80		
9RHA100	1	11.37	11.28	0.79	0.75	0.18
	2	11.49	11.45	0.35		
	3	11.40	11.29	0.96		
	4	11.47	11.41	0.52		
	5	11.47	11.38	0.78		
	6	11.40	11.30	0.88		
	7	11.48	11.39	0.78		
	8	11.45	11.36	0.79		
	9	11.45	11.36	0.79		
	10	11.24	11.14	0.89		

Table B-2 Experimental data of firing shrinkage of fired bodies at 950 °C

950 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage (%)	Avg. (%)	S.D.
NC	1	11.17	10.95	1.97	1.89	0.23
	2	11.15	10.97	1.61		
	3	11.26	11.00	2.31		
	4	11.33	11.12	1.85		
	5	11.20	11.00	1.79		
	6	11.19	10.95	2.14		
	7	11.16	10.97	1.70		
	8	11.16	10.93	2.06		
	9	11.25	11.07	1.60		
	10	11.25	11.04	1.87		
NF	1	11.15	10.95	1.79	1.78	0.48
	2	11.07	10.86	1.90		
	3	11.41	11.30	0.96		
	4	11.23	11.10	1.16		
	5	11.15	10.93	1.97		
	6	11.41	11.26	1.31		
	7	11.19	10.93	2.32		
	8	11.11	10.89	1.98		
	9	11.13	10.90	2.07		
	10	11.19	10.93	2.32		
NS50	1	11.45	11.22	2.01	1.73	0.32
	2	11.29	11.14	1.33		
	3	11.39	11.22	1.49		
	4	11.37	11.20	1.50		
	5	11.35	11.12	2.03		
	6	11.32	11.11	1.86		
	7	11.47	11.23	2.09		
	8	11.44	11.30	1.22		
	9	11.43	11.20	2.01		
	10	11.37	11.17	1.76		
NS100	1	11.42	11.22	1.75	1.92	0.24
	2	11.38	11.14	2.11		
	3	11.34	11.13	1.85		
	4	11.30	11.05	2.21		
	5	11.29	11.04	2.21		
	6	11.39	11.22	1.49		
	7	11.28	11.04	2.13		
	8	11.42	11.23	1.66		
	9	11.35	11.14	1.85		
	10	11.43	11.21	1.92		
3RHA50	1	11.20	11.00	1.79	1.72	0.24
	2	11.35	11.10	2.20		
	3	11.14	10.97	1.53		
	4	11.14	10.93	1.89		
	5	11.28	11.12	1.42		
	6	11.25	11.04	1.87		
	7	11.14	10.96	1.62		
	8	11.31	11.10	1.86		
	9	11.27	11.10	1.51		
	10	11.23	11.06	1.51		

950 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage (%)	Avg. (%)	S.D.
3RHA100	1	11.20	11.02	1.61	1.71	0.15
	2	11.17	10.99	1.61		
	3	11.15	10.96	1.70		
	4	11.31	11.13	1.59		
	5	11.27	11.07	1.77		
	6	11.27	11.09	1.60		
	7	11.29	11.09	1.77		
	8	11.23	11.05	1.60		
	9	11.28	11.08	1.77		
	10	11.17	10.94	2.06		
6RHA50	1	11.36	11.20	1.41	1.67	0.19
	2	11.40	11.23	1.49		
	3	11.44	11.25	1.66		
	4	11.43	11.24	1.66		
	5	11.29	11.10	1.68		
	6	11.29	11.08	1.86		
	7	11.36	11.16	1.76		
	8	11.29	11.13	1.42		
	9	11.38	11.15	2.02		
	10	11.45	11.25	1.75		
6RHA100	1	11.41	11.24	1.49	1.58	0.20
	2	11.47	11.31	1.39		
	3	11.36	11.17	1.67		
	4	11.33	11.12	1.85		
	5	11.30	11.11	1.68		
	6	11.27	11.13	1.24		
	7	11.26	11.09	1.51		
	8	11.38	11.22	1.41		
	9	11.30	11.11	1.68		
	10	11.39	11.18	1.84		
9RHA50	1	11.37	11.16	1.85	1.42	0.23
	2	11.51	11.37	1.22		
	3	11.32	11.15	1.50		
	4	11.25	11.07	1.60		
	5	11.37	11.19	1.58		
	6	11.46	11.34	1.05		
	7	11.42	11.27	1.31		
	8	11.47	11.32	1.31		
	9	11.31	11.16	1.33		
	10	11.29	11.12	1.51		
9RHA100	1	11.40	11.22	1.58	1.55	0.13
	2	11.26	11.10	1.42		
	3	11.30	11.14	1.42		
	4	11.38	11.20	1.58		
	5	11.48	11.31	1.48		
	6	11.43	11.24	1.66		
	7	11.48	11.30	1.57		
	8	11.30	11.14	1.42		
	9	11.31	11.14	1.50		
	10	11.44	11.23	1.84		

Table B-3 Experimental data of firing shrinkage of fired bodies at 1000 °C

1000 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage (%)	Avg. (%)	S.D.
NC	1	11.28	10.76	4.61	3.72	0.52
	2	11.10	10.78	2.88		
	3	11.29	10.93	3.19		
	4	11.15	10.70	4.04		
	5	11.31	10.86	3.98		
	6	11.28	10.84	3.90		
	7	11.03	10.64	3.54		
	8	11.22	10.76	4.10		
	9	11.27	10.84	3.82		
	10	11.30	10.94	3.19		
NF	1	11.09	10.65	3.97	3.31	0.39
	2	11.21	10.92	2.59		
	3	11.17	10.84	2.95		
	4	11.05	10.64	3.71		
	5	11.10	10.74	3.24		
	6	11.10	10.72	3.42		
	7	11.08	10.71	3.34		
	8	11.12	10.78	3.06		
	9	11.26	10.86	3.55		
	10	11.15	10.79	3.23		
NS50	1	11.44	11.20	2.10	3.11	0.44
	2	11.40	11.04	3.16		
	3	11.46	11.12	2.97		
	4	11.43	11.05	3.32		
	5	11.46	11.09	3.23		
	6	11.39	11.05	2.99		
	7	11.34	10.99	3.09		
	8	11.39	10.96	3.78		
	9	11.38	10.98	3.51		
	10	11.36	11.02	2.99		
NS100	1	11.47	11.07	3.49	3.16	0.42
	2	11.39	10.99	3.51		
	3	11.34	11.03	2.73		
	4	11.45	11.08	3.23		
	5	11.30	11.03	2.39		
	6	11.35	11.05	2.64		
	7	11.50	11.10	3.48		
	8	11.44	11.08	3.15		
	9	11.43	11.04	3.41		
	10	11.45	11.04	3.58		
3RHA50	1	11.19	10.80	3.49	3.06	0.41
	2	11.22	10.92	2.67		
	3	11.22	10.90	2.85		
	4	11.07	10.67	3.61		
	5	11.29	10.93	3.19		
	6	11.12	10.84	2.52		
	7	11.09	10.68	3.70		
	8	11.12	10.80	2.88		
	9	11.06	10.75	2.80		
	10	11.10	10.78	2.88		

1000 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage (%)	Avg. (%)	S.D.
3RHA100	1	11.08	10.66	3.79	3.07	0.45
	2	11.06	10.77	2.62		
	3	11.08	10.74	3.07		
	4	11.20	10.94	2.32		
	5	11.26	10.90	3.20		
	6	11.33	11.03	2.65		
	7	11.36	10.99	3.26		
	8	11.30	10.97	2.92		
	9	11.27	10.90	3.28		
	10	11.18	10.78	3.58		
6RHA50	1	11.25	10.95	2.67	2.83	0.48
	2	11.26	10.83	3.82		
	3	11.34	10.97	3.26		
	4	11.27	11.00	2.40		
	5	11.36	11.02	2.99		
	6	11.34	11.04	2.65		
	7	11.50	11.15	3.04		
	8	11.40	11.16	2.11		
	9	11.47	11.15	2.79		
	10	11.33	11.04	2.56		
6RHA100	1	11.38	11.05	2.90	2.86	0.31
	2	11.35	11.05	2.64		
	3	11.30	10.93	3.27		
	4	11.28	11.00	2.48		
	5	11.34	11.00	3.00		
	6	11.37	10.98	3.43		
	7	11.31	11.00	2.74		
	8	11.29	10.97	2.83		
	9	11.42	11.14	2.45		
	10	11.36	11.04	2.82		
9RHA50	1	11.42	11.10	2.80	2.50	0.28
	2	11.24	10.95	2.58		
	3	11.24	10.95	2.58		
	4	11.30	11.06	2.12		
	5	11.30	10.99	2.74		
	6	11.14	10.90	2.15		
	7	11.32	11.08	2.12		
	8	11.29	11.02	2.39		
	9	11.35	11.03	2.82		
	10	11.30	11.00	2.65		
9RHA100	1	11.64	11.33	2.66	2.46	0.33
	2	11.59	11.29	2.59		
	3	11.56	11.29	2.34		
	4	11.60	11.32	2.41		
	5	11.34	11.08	2.29		
	6	11.40	11.05	3.07		
	7	11.41	11.16	2.19		
	8	11.20	10.90	2.68		
	9	11.57	11.28	2.51		
	10	11.43	11.22	1.84		

Table B-4 Experimental data of firing shrinkage of fired bodies at 1050 °C

1050 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage	Avg. (%)	S.D.
NC	1	11.25	10.73	4.62	5.20	0.32
	2	11.20	10.58	5.54		
	3	11.25	10.70	4.89		
	4	11.16	10.55	5.47		
	5	11.23	10.62	5.43		
	6	11.18	10.60	5.19		
	7	11.26	10.67	5.24		
	8	11.20	10.66	4.82		
	9	11.14	10.53	5.48		
	10	11.20	10.60	5.36		
NF	1	11.20	10.67	4.73	4.62	0.49
	2	11.20	10.70	4.46		
	3	11.20	10.65	4.91		
	4	11.20	10.70	4.46		
	5	11.15	10.67	4.30		
	6	11.18	10.60	5.19		
	7	11.12	10.60	4.68		
	8	11.21	10.76	4.01		
	9	11.11	10.50	5.49		
	10	11.18	10.74	3.94		
NS50	1	11.39	10.87	4.57	4.41	0.20
	2	11.39	10.90	4.30		
	3	11.36	10.87	4.31		
	4	11.27	10.74	4.70		
	5	11.38	10.87	4.48		
	6	11.34	10.87	4.14		
	7	11.44	10.94	4.37		
	8	11.43	10.96	4.11		
	9	11.48	10.95	4.62		
	10	11.25	10.74	4.53		
NS100	1	11.35	10.84	4.49	4.38	0.30
	2	11.29	-	-		
	3	11.35	10.83	4.58		
	4	11.36	10.86	4.40		
	5	11.33	10.86	4.15		
	6	11.31	10.78	4.69		
	7	11.51	10.99	4.52		
	8	11.40	10.98	3.68		
	9	11.30	10.80	4.42		
	10	11.39	10.88	4.48		
3RHA50	1	11.31	10.82	4.33	4.27	0.21
	2	11.20	10.70	4.46		
	3	11.13	10.67	4.13		
	4	11.21	10.74	4.19		
	5	11.30	10.80	4.42		
	6	11.18	10.69	4.38		
	7	11.21	10.73	4.28		
	8	11.20	10.78	3.75		
	9	11.09	10.62	4.24		
	10	11.23	10.73	4.45		

1050 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage (%)	Avg. (%)	S.D.
3RHA100	1	11.20	10.72	4.29	4.27	0.19
	2	11.15	10.69	4.13		
	3	11.32	10.81	4.51		
	4	11.17	10.66	4.57		
	5	11.26	10.81	4.00		
	6	11.20	10.70	4.46		
	7	11.15	10.70	4.04		
	8	11.22	10.74	4.28		
	9	11.34	10.86	4.23		
	10	11.20	10.73	4.20		
6RHA50	1	11.35	10.91	3.88	3.94	0.11
	2	11.26	10.82	3.91		
	3	11.34	10.90	3.88		
	4	11.25	10.80	4.00		
	5	11.19	10.73	4.11		
	6	11.38	10.91	4.13		
	7	11.44	11.00	3.85		
	8	11.37	10.93	3.87		
	9	11.30	10.85	3.98		
	10	11.52	11.08	3.82		
6RHA100	1	11.17	10.71	4.12	4.09	0.72
	2	11.60	10.90	6.03		
	3	11.27	10.84	3.82		
	4	11.42	10.96	4.03		
	5	11.34	10.90	3.88		
	6	11.24	10.86	3.38		
	7	11.39	10.93	4.04		
	8	11.33	10.90	3.80		
	9	11.30	10.84	4.07		
	10	11.31	10.89	3.71		
9RHA50	1	11.18	10.76	3.76	3.45	0.27
	2	11.28	10.88	3.55		
	3	11.44	11.06	3.32		
	4	11.28	10.95	2.93		
	5	11.36	10.94	3.70		
	6	11.30	10.92	3.36		
	7	11.32	10.90	3.71		
	8	11.44	11.08	3.15		
	9	11.37	10.96	3.61		
	10	11.33	10.94	3.44		
9RHA100	1	11.42	11.01	3.59	3.62	0.19
	2	11.34	10.92	3.70		
	3	11.34	10.96	3.35		
	4	11.45	11.08	3.23		
	5	11.28	10.87	3.63		
	6	11.54	11.11	3.73		
	7	11.47	11.05	3.66		
	8	11.36	10.94	3.70		
	9	11.52	11.10	3.65		
	10	11.50	11.05	3.91		

Table B-5 Experimental data of firing shrinkage of fired bodies at 1100 °C

1100 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage (%)	Avg. (%)	S.D.
NC	1	11.31	10.63	6.01	5.89	0.19
	2	11.28	10.62	5.85		
	3	11.15	10.49	5.92		
	4	11.30	10.66	5.66		
	5	11.26	10.59	5.95		
	6	11.24	10.55	6.14		
	7	11.22	10.55	5.97		
	8	11.24	10.55	6.14		
	9	11.16	10.53	5.65		
	10	11.17	10.54	5.64		
NF	1	11.08	10.50	5.23	5.25	0.20
	2	11.20	10.59	5.45		
	3	11.16	10.62	4.84		
	4	11.20	10.64	5.00		
	5	11.06	10.47	5.33		
	6	11.17	10.58	5.28		
	7	11.24	10.62	5.52		
	8	11.14	10.55	5.30		
	9	11.20	10.60	5.36		
	10	11.29	10.70	5.23		
NS50	1	11.45	10.89	4.89	5.03	0.13
	2	11.38	10.82	4.92		
	3	11.42	10.82	5.25		
	4	11.38	10.82	4.92		
	5	11.44	10.86	5.07		
	6	11.56	10.98	5.02		
	7	11.34	10.78	4.94		
	8	11.28	10.69	5.23		
	9	11.41	10.84	5.00		
	10	11.48	10.90	5.05		
NS100	1	11.42	10.84	5.08	4.99	0.22
	2	11.48	10.90	5.05		
	3	11.31	10.74	5.04		
	4	11.30	10.73	5.04		
	5	11.34	10.80	4.76		
	6	11.44	10.84	5.24		
	7	11.43	10.87	4.90		
	8	11.45	10.85	5.24		
	9	11.35	10.84	4.49		
	10	11.39	10.82	5.00		
3RHA50	1	11.14	10.60	4.85	4.88	0.18
	2	11.19	10.66	4.74		
	3	11.15	10.65	4.48		
	4	11.10	10.56	4.86		
	5	11.30	10.72	5.13		
	6	11.13	10.58	4.94		
	7	11.14	10.60	4.85		
	8	11.20	10.64	5.00		
	9	11.20	10.65	4.91		
	10	11.19	10.63	5.00		

1100 °C						
Formula	Specimen #	Length before firing (cm)	Length after fired (cm)	Linear firing shrinkage (%)	Avg. (%)	S.D.
3RHA100	1	11.24	10.70	4.80	4.89	0.12
	2	11.15	10.63	4.66		
	3	11.28	10.71	5.05		
	4	11.20	10.66	4.82		
	5	11.32	10.75	5.04		
	6	11.40	10.85	4.82		
	7	11.14	10.60	4.85		
	8	11.33	10.78	4.85		
	9	11.13	10.58	4.94		
	10	11.38	10.81	5.01		
6RHA50	1	11.50	11.00	4.35	4.41	0.26
	2	11.28	10.78	4.43		
	3	11.40	10.89	4.47		
	4	11.31	10.80	4.51		
	5	11.26	10.77	4.35		
	6	11.42	10.91	4.47		
	7	11.37	10.89	4.22		
	8	11.37	10.80	5.01		
	9	11.23	10.76	4.19		
	10	11.36	10.90	4.05		
6RHA100	1	11.39	10.86	4.65	4.62	0.12
	2	11.25	10.72	4.71		
	3	11.45	10.92	4.63		
	4	11.43	10.90	4.64		
	5	11.31	10.80	4.51		
	6	11.33	10.80	4.68		
	7	11.33	10.81	4.59		
	8	11.35	10.80	4.85		
	9	11.35	10.84	4.49		
	10	11.32	10.82	4.42		
9RHA50	1	11.12	10.68	3.96	4.03	0.12
	2	11.30	10.84	4.07		
	3	11.37	10.93	3.87		
	4	11.38	10.94	3.87		
	5	11.45	10.97	4.19		
	6	11.30	10.85	3.98		
	7	11.25	10.80	4.00		
	8	11.23	10.76	4.19		
	9	11.28	10.82	4.08		
	10	11.22	10.76	4.10		
9RHA100	1	11.41	10.94	4.12	4.08	0.26
	2	11.34	10.92	3.70		
	3	11.29	10.83	4.07		
	4	11.51	11.10	3.56		
	5	11.31	10.84	4.16		
	6	11.59	11.10	4.23		
	7	11.67	11.19	4.11		
	8	11.29	10.80	4.34		
	9	11.32	10.82	4.42		
	10	11.51	11.04	4.08		

Appendix C

Table C Experimental data of bulk density and water absorption of fired bodies at 900°C

900 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
NC	1	6.12	3.87	6.96	27.18	13.73	1.97
	2	5.82	3.68	6.66	28.19	14.43	1.95
	3	8.20	5.19	9.38	28.16	14.39	1.95
	4	6.14	3.88	7.01	27.80	14.17	1.96
	5	5.86	3.71	6.68	27.61	13.99	1.97
Avg.					27.79	14.14	1.96
S.D.					0.42	0.29	0.01
NF	1	6.87	4.33	7.91	29.05	15.14	1.91
	2	6.79	4.27	7.85	29.61	15.61	1.89
	3	6.43	4.06	7.39	28.83	14.93	1.92
	4	6.39	4.03	7.34	28.70	14.87	1.92
	5	6.99	4.41	8.04	28.93	15.02	1.92
Avg.					29.02	15.11	1.91
S.D.					0.35	0.30	0.01
NS50	1	6.38	3.96	7.42	30.06	16.30	1.84
	2	7.14	4.41	8.28	29.46	15.97	1.84
	3	6.65	4.12	7.71	29.53	15.94	1.85
	4	5.51	3.44	6.39	29.83	15.97	1.86
	5	6.78	4.21	7.85	29.40	15.78	1.86
Avg.					29.65	15.99	1.85
S.D.					0.28	0.19	0.01
NS100	1	6.44	3.97	7.46	29.23	15.84	1.84
	2	6.57	4.08	7.61	29.46	15.83	1.86
	3	6.33	3.91	7.31	28.82	15.48	1.86
	4	6.19	3.87	7.22	30.75	16.64	1.84
	5	6.66	4.13	7.72	29.53	15.92	1.85
Avg.					29.56	15.94	1.85
S.D.					0.72	0.43	0.01
3RHA50	1	6.06	3.79	7.01	29.50	15.68	1.88
	2	6.29	3.94	7.26	29.22	15.42	1.89
	3	6.69	4.18	7.73	29.30	15.55	1.88
	4	6.14	3.85	7.11	29.75	15.80	1.88
	5	6.92	4.31	7.99	29.08	15.46	1.87
Avg.					29.37	15.58	1.88
S.D.					0.27	0.16	0.01
3RHA100	1	6.98	4.36	8.09	29.76	15.90	1.87
	2	6.89	4.31	7.95	29.12	15.38	1.89
	3	6.52	4.07	7.52	28.99	15.34	1.88
	4	6.88	4.31	7.97	29.78	15.84	1.87
	5	6.40	4.00	7.39	29.20	15.47	1.88
Avg.					29.37	15.59	1.88
S.D.					0.37	0.27	0.01

900 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
6RHA50	1	6.97	4.33	8.11	30.16	16.36	1.84
	2	6.52	4.05	7.57	29.83	16.10	1.85
	3	6.55	4.07	7.62	30.14	16.34	1.84
	4	6.63	4.12	7.69	29.69	15.99	1.85
	5	7.64	4.71	8.90	30.07	16.49	1.82
Avg.					29.98	16.26	1.84
S.D.					0.21	0.20	0.01
6RHA100	1	6.62	4.10	7.69	29.81	16.16	1.84
	2	6.42	3.99	7.51	30.97	16.98	1.82
	3	6.35	3.95	7.36	29.62	15.91	1.86
	4	6.62	4.11	7.69	29.89	16.16	1.84
	5	6.33	3.93	7.39	30.64	16.75	1.82
Avg.					30.18	16.39	1.84
S.D.					0.58	0.45	0.02
9RHA50	1	7.09	4.39	8.30	30.95	17.07	1.81
	2	7.19	4.44	8.42	30.90	17.11	1.80
	3	6.71	4.15	7.85	30.81	16.99	1.81
	4	6.92	4.28	8.12	31.25	17.34	1.80
	5	6.65	4.11	7.79	30.98	17.14	1.80
Avg.					30.98	17.13	1.80
S.D.					0.16	0.13	0.00
9RHA100	1	6.60	4.07	7.73	30.87	17.12	1.80
	2	6.31	3.88	7.39	30.77	17.12	1.79
	3	6.83	4.21	7.97	30.32	16.69	1.81
	4	6.55	4.08	7.67	31.20	17.10	1.82
	5	6.49	4.01	7.58	30.53	16.80	1.81
Avg.					30.74	16.96	1.81
S.D.					0.33	0.21	0.01

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table C-2 Experimental data of bulk density and water absorption of fired bodies at 950 °C

950 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
NC	1	6.78	4.28	7.69	26.69	13.42	1.98
	2	7.97	5.02	9.00	25.88	12.92	2.00
	3	6.32	3.99	7.09	24.84	12.18	2.03
	4	6.90	4.36	7.71	24.18	11.74	2.05
	5	6.52	4.13	7.37	26.23	13.04	2.01
Avg.					25.56	12.66	2.01
S.D.					1.03	0.68	0.03
NF	1	6.99	4.42	7.96	27.40	13.88	1.97
	2	7.22	4.55	8.23	27.45	13.99	1.96
	3	6.94	4.38	7.93	27.89	14.27	1.95
	4	7.63	4.82	8.73	28.13	14.42	1.95
	5	6.65	4.19	7.55	26.79	13.53	1.97
Avg.					27.53	14.02	1.96
S.D.					0.52	0.34	0.01
NS50	1	7.06	4.42	8.15	29.22	15.44	1.89
	2	6.67	4.12	7.66	27.97	14.84	1.88
	3	6.84	4.26	7.86	28.33	14.91	1.89
	4	6.33	3.93	7.28	28.36	15.01	1.88
	5	6.45	4.00	7.39	27.73	14.57	1.90
Avg.					28.32	14.96	1.89
S.D.					0.57	0.32	0.01
NS100	1	7.45	4.62	8.54	27.81	14.63	1.89
	2	6.72	4.16	7.65	26.65	13.84	1.92
	3	6.95	4.30	7.98	27.99	14.82	1.88
	4	6.81	4.22	7.79	27.45	14.39	1.90
	5	6.48	4.02	7.37	26.57	13.73	1.93
Avg.					27.29	14.28	1.91
S.D.					0.66	0.48	0.02
3RHA50	1	6.50	4.07	7.47	28.53	14.92	1.91
	2	7.05	4.42	8.08	28.14	14.61	1.92
	3	6.72	4.21	7.66	27.25	13.99	1.94
	4	6.75	4.23	7.72	27.79	14.37	1.93
	5	6.44	4.03	7.36	27.63	14.29	1.93
Avg.					27.87	14.44	1.92
S.D.					0.49	0.35	0.01
3RHA100	1	7.07	4.43	8.10	28.07	14.57	1.92
	2	6.53	4.08	7.51	28.57	15.01	1.90
	3	6.62	4.14	7.57	27.70	14.35	1.92
	4	6.62	4.14	7.59	28.12	14.65	1.91
	5	6.57	4.10	7.49	27.14	14.00	1.93
Avg.					27.92	14.52	1.92
S.D.					0.53	0.37	0.01
6RHA50	1	6.75	4.19	7.76	28.29	14.96	1.88
	2	6.44	4.00	7.41	28.45	15.06	1.88
	3	6.38	3.97	7.33	28.27	14.89	1.89
	4	5.84	3.63	6.79	30.06	16.27	1.84
	5	6.36	3.96	7.38	29.82	16.04	1.85
Avg.					28.98	15.44	1.87
S.D.					0.89	0.65	0.02

950 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
6RHA100	1	7.09	4.39	8.16	28.38	15.09	1.87
	2	6.76	4.20	7.81	29.09	15.53	1.87
	3	7.16	4.45	8.23	28.31	14.94	1.89
	4	7.18	4.47	8.28	28.87	15.32	1.88
	5	7.04	4.37	8.08	28.03	14.77	1.89
Avg.					28.54	15.13	1.88
S.D.					0.43	0.30	0.01
9RHA50	1	6.97	4.31	8.07	29.26	15.78	1.85
	2	6.51	4.03	7.57	29.94	16.28	1.83
	3	7.23	4.46	8.39	29.52	16.04	1.83
	4	6.76	4.18	7.85	29.70	16.12	1.84
	5	7.53	4.67	8.73	29.56	15.94	1.85
Avg.					29.59	16.03	1.84
S.D.					0.25	0.19	0.01
9RHA100	1	6.61	4.08	7.65	29.13	15.73	1.85
	2	6.58	4.08	7.67	30.36	16.57	1.83
	3	7.33	4.53	8.52	29.82	16.23	1.83
	4	6.39	3.95	7.42	29.68	16.12	1.84
	5	6.70	4.14	7.78	29.67	16.12	1.83
Avg.					29.73	16.15	1.83
S.D.					0.44	0.30	0.01

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table C-3 Experimental data of bulk density and water absorption of fired bodies at
1000 °C

1000 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
NC	1	6.75	4.25	7.48	22.60	10.81	2.08
	2	6.39	3.99	6.97	19.46	9.08	2.14
	3	6.13	3.82	6.66	18.66	8.65	2.15
	4	7.34	4.59	8.05	20.52	9.67	2.11
	5	6.84	4.26	7.42	18.35	8.48	2.16
Avg.					19.92	9.34	2.13
S.D.					1.72	0.95	0.03
NF	1	6.90	4.32	7.69	23.44	11.45	2.04
	2	6.60	4.14	7.32	22.64	10.91	2.07
	3	6.06	3.80	6.75	23.39	11.39	2.05
	4	6.02	3.76	6.66	22.07	10.63	2.07
	5	6.58	4.11	7.26	21.59	10.33	2.08
Avg.					22.63	10.94	2.06
S.D.					0.81	0.48	0.02
NS50	1	6.16	3.80	6.89	23.62	11.85	1.99
	2	6.85	4.23	7.76	25.78	13.28	1.93
	3	6.69	4.17	7.57	25.88	13.15	1.96
	4	6.72	4.13	7.54	24.05	12.20	1.96
	5	6.53	4.03	7.29	23.31	11.64	2.00
Avg.					24.53	12.43	1.97
S.D.					1.22	0.75	0.02
NS100	1	6.78	4.18	7.54	22.62	11.21	2.01
	2	6.33	3.93	7.06	23.32	11.53	2.02
	3	6.07	3.76	6.82	24.51	12.36	1.98
	4	5.85	3.64	6.64	26.33	13.50	1.94
	5	6.12	3.77	6.81	22.70	11.27	2.01
Avg.					23.90	11.98	1.99
S.D.					1.56	0.97	0.03
3RHA50	1	6.39	3.95	7.12	23.03	11.42	2.01
	2	7.46	4.64	8.38	24.60	12.33	1.99
	3	6.86	4.25	7.68	23.91	11.95	1.99
	4	7.62	4.69	8.46	22.28	11.02	2.01
	5	6.37	3.95	7.12	23.66	11.77	2.00
Avg.					23.49	11.70	2.00
S.D.					0.88	0.50	0.01
3RHA100	1	6.42	3.99	7.25	25.46	12.93	1.96
	2	5.52	3.43	6.16	23.44	11.59	2.02
	3	6.22	3.86	6.95	23.62	11.74	2.01
	4	6.16	3.83	6.95	25.32	12.82	1.97
	5	6.05	3.75	6.70	22.03	10.74	2.04
Avg.					23.98	11.97	2.00
S.D.					1.43	0.91	0.03

1000 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
6RHA50	1	6.43	3.98	7.28	25.76	13.22	1.94
	2	7.13	4.39	8.06	25.34	13.04	1.94
	3	5.60	3.45	6.31	24.83	12.68	1.95
	4	5.97	3.68	6.73	24.92	12.73	1.95
	5	5.94	3.67	6.71	25.33	12.96	1.95
Avg.					25.23	12.93	1.95
S.D.					0.37	0.22	0.01
6RHA100	1	6.62	4.06	7.48	25.15	12.99	1.93
	2	6.74	4.16	7.59	24.78	12.61	1.96
	3	6.79	4.16	7.58	23.10	11.63	1.98
	4	6.41	3.95	7.23	25.00	12.79	1.95
	5	6.62	4.07	7.43	24.11	12.24	1.96
Avg.					24.43	12.45	1.96
S.D.					0.84	0.54	0.02
9RHA50	1	7.01	4.31	7.99	26.63	13.98	1.90
	2	6.76	4.16	7.69	26.35	13.76	1.91
	3	6.91	4.25	7.91	27.32	14.47	1.88
	4	6.25	3.83	7.13	26.67	14.08	1.89
	5	6.29	3.88	7.23	28.06	14.94	1.87
Avg.					27.00	14.25	1.89
S.D.					0.69	0.47	0.01
9RHA100	1	6.46	3.96	7.32	25.60	13.31	1.92
	2	6.34	3.89	7.21	26.20	13.72	1.90
	3	6.78	4.15	7.69	25.71	13.42	1.91
	4	6.32	3.88	7.21	26.73	14.08	1.89
	5	5.97	3.67	6.80	26.52	13.90	1.90
Avg.					26.15	13.69	1.90
S.D.					0.49	0.32	0.01

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table C-4 Experimental data of bulk density and water absorption of fired bodies at
1050 °C

1050 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
NC	1	7.06	4.34	7.50	13.92	6.23	2.23
	2	7.04	4.29	7.38	11.00	4.83	2.27
	3	7.73	4.75	8.19	13.37	5.95	2.24
	4	7.07	4.31	7.39	10.39	4.53	2.29
	5	8.04	4.89	8.43	11.02	4.85	2.26
Avg.					11.94	5.28	2.26
S.D.					1.59	0.76	0.02
NF	1	7.49	4.62	8.04	16.08	7.34	2.18
	2	7.20	4.42	7.69	14.98	6.81	2.19
	3	6.66	4.09	7.15	16.01	7.36	2.17
	4	6.83	4.25	7.45	19.38	9.08	2.13
	5	6.62	4.09	7.16	17.59	8.16	2.15
Avg.					16.81	7.75	2.16
S.D.					1.71	0.89	0.03
NS50	1	7.07	4.29	7.68	17.99	8.63	2.08
	2	7.14	4.33	7.79	18.79	9.10	2.06
	3	6.92	4.21	7.54	18.62	8.96	2.07
	4	6.64	4.01	7.21	17.81	8.58	2.07
	5	6.83	4.14	7.39	17.23	8.20	2.09
Avg.					18.09	8.69	2.07
S.D.					0.63	0.35	0.01
NS100	1	7.47	4.44	8.05	16.07	7.76	2.06
	2	6.81	4.18	7.42	18.83	8.96	2.10
	3	6.42	3.93	7.02	19.42	9.35	2.07
	4	6.82	4.17	7.43	18.71	8.94	2.09
	5	6.24	3.83	6.81	19.13	9.13	2.09
Avg.					18.43	8.83	2.08
S.D.					1.35	0.62	0.01
3RHA50	1	7.35	4.51	8.02	19.09	9.12	2.09
	2	6.98	4.27	7.58	18.13	8.60	2.10
	3	6.92	4.26	7.59	20.12	9.68	2.07
	4	7.04	4.32	7.66	18.56	8.81	2.10
	5	7.57	4.64	8.24	18.61	8.85	2.10
Avg.					18.90	9.01	2.09
S.D.					0.76	0.42	0.01
3RHA100	1	6.76	4.14	7.34	18.13	8.58	2.11
	2	6.28	3.85	6.82	18.18	8.60	2.11
	3	6.59	4.04	7.21	19.56	9.41	2.07
	4	5.98	3.65	6.49	17.96	8.53	2.10
	5	7.02	4.31	7.68	19.58	9.40	2.08
Avg.					18.68	8.90	2.09
S.D.					0.82	0.46	0.02

1050 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
6RHA50	1	6.82	4.19	7.57	22.19	11.00	2.01
	2	6.44	3.96	7.14	22.01	10.87	2.02
	3	6.79	4.17	7.54	22.26	11.05	2.01
	4	5.87	3.62	6.52	22.41	11.07	2.02
	5	6.52	3.99	7.19	20.94	10.28	2.03
Avg.					21.96	10.85	2.02
S.D.					0.59	0.33	0.01
6RHA100	1	6.83	4.13	7.51	20.12	9.96	2.01
	2	6.39	3.89	7.03	20.38	10.02	2.03
	3	6.44	3.94	7.13	21.63	10.71	2.01
	4	6.83	4.18	7.53	20.90	10.25	2.03
	5	6.67	4.08	7.37	21.28	10.49	2.02
Avg.					20.86	10.29	2.02
S.D.					0.62	0.32	0.01
9RHA50	1	6.92	4.24	7.81	24.93	12.86	1.93
	2	6.99	4.26	7.83	23.53	12.02	1.95
	3	6.39	3.91	7.17	23.93	12.21	1.95
	4	7.14	4.36	8.05	24.66	12.75	1.93
	5	7.22	4.42	8.10	23.91	12.19	1.96
Avg.					24.19	12.40	1.94
S.D.					0.58	0.37	0.01
9RHA100	1	6.25	3.76	6.92	21.20	10.72	1.97
	2	6.88	4.19	7.69	23.14	11.77	1.96
	3	6.82	4.15	7.64	23.50	12.02	1.95
	4	6.07	3.70	6.79	23.30	11.86	1.96
	5	7.35	4.48	8.19	22.64	11.43	1.97
Avg.					22.76	11.56	1.96
S.D.					0.92	0.52	0.01

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table C-5 Experimental data of bulk density and water absorption of fired bodies at
1100 °C

1100 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
NC	1	6.49	3.91	6.67	6.52	2.77	2.34
	2	6.32	3.81	6.53	7.72	3.32	2.32
	3	6.28	3.79	6.50	8.12	3.50	2.31
	4	6.29	3.81	6.56	9.82	4.29	2.28
	5	7.24	4.36	7.44	6.49	2.76	2.34
Avg.					7.73	3.33	2.32
S.D.					1.37	0.63	0.03
NF	1	7.33	4.46	7.73	12.23	5.46	2.23
	2	6.92	4.19	7.27	11.36	5.06	2.24
	3	6.73	4.09	7.12	12.87	5.79	2.21
	4	6.73	4.12	7.13	13.29	5.94	2.23
	5	6.13	3.76	6.52	14.13	6.36	2.21
Avg.					12.78	5.72	2.23
S.D.					1.05	0.49	0.01
NS50	1	6.56	3.96	7.06	16.13	7.62	2.11
	2	7.31	4.38	7.80	14.33	6.70	2.13
	3	7.20	4.31	7.74	15.74	7.50	2.09
	4	6.55	3.95	7.02	15.31	7.18	2.13
	5	6.71	4.04	7.19	15.24	7.15	2.12
Avg.					15.35	7.23	2.12
S.D.					0.67	0.36	0.02
NS100	1	6.34	3.78	6.74	13.51	6.31	2.14
	2	6.89	4.13	7.36	14.55	6.82	2.13
	3	7.41	4.44	7.89	13.91	6.48	2.14
	4	7.88	4.73	8.43	14.86	6.98	2.12
	5	6.52	3.89	6.95	14.05	6.60	2.12
Avg.					14.18	6.64	2.13
S.D.					0.53	0.27	0.01
3RHA50	1	6.88	4.17	7.36	15.05	6.98	2.15
	2	6.74	4.07	7.19	14.42	6.68	2.15
	3	7.99	4.84	8.53	14.63	6.76	2.16
	4	7.47	4.54	8.01	15.56	7.23	2.15
	5	6.27	3.82	6.75	16.38	7.66	2.13
Avg.					15.21	7.06	2.15
S.D.					0.79	0.40	0.01
3RHA100	1	7.68	4.67	8.28	16.62	7.81	2.12
	2	6.91	4.18	7.36	14.15	6.51	2.17
	3	7.32	4.44	7.81	14.54	6.69	2.17
	4	6.92	4.19	7.39	14.69	6.79	2.16
	5	6.89	4.15	7.32	13.56	6.24	2.17
Avg.					14.71	6.81	2.15
S.D.					1.15	0.60	0.02

1100 °C							
Formula	Sample #	D (g)	S (g)	W (g)	A.P. (%)	W.A. (%)	B.D. (g/cm ³)
6RHA50	1	6.37	3.81	6.89	16.88	8.16	2.06
	2	6.30	3.79	6.88	18.77	9.21	2.03
	3	6.67	4.01	7.25	17.90	8.70	2.05
	4	6.12	3.66	6.64	17.45	8.50	2.05
	5	6.86	4.13	7.49	18.75	9.18	2.04
Avg.					17.95	8.75	2.05
S.D.					0.82	0.45	0.01
6RHA100	1	7.43	4.49	8.05	17.42	8.34	2.08
	2	6.45	3.90	6.98	17.21	8.22	2.09
	3	6.98	4.22	7.56	17.37	8.31	2.08
	4	6.34	3.84	6.90	18.30	8.83	2.07
	5	6.38	3.87	6.94	18.24	8.78	2.07
Avg.					17.71	8.50	2.08
S.D.					0.52	0.29	0.01
9RHA50	1	6.48	3.91	7.15	20.68	10.34	1.99
	2	6.88	4.18	7.61	21.28	10.61	2.00
	3	6.27	3.81	6.95	21.66	10.85	1.99
	4	6.69	4.06	7.41	21.49	10.76	1.99
	5	6.64	4.03	7.35	21.39	10.69	1.99
Avg.					21.30	10.65	1.99
S.D.					0.37	0.19	0.00
9RHA100	1	6.51	3.96	7.19	21.05	10.45	2.01
	2	6.70	4.07	7.41	21.26	10.60	2.00
	3	6.73	4.08	7.47	21.83	11.00	1.98
	4	7.19	4.37	8.01	22.53	11.40	1.97
	5	6.95	4.19	7.65	20.23	10.07	2.00
Avg.					21.38	10.70	1.99
S.D.					0.86	0.51	0.02

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Appendix D

Table D Experimental data of modulus of rupture of green bodies

Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
NC	1	9.05	28.04	7.71	5.57	1.53
	2	9.05	16.98	4.67		
	3	9.05	19.84	5.46		
	4	9.00	13.35	3.73		
	5	9.05	28.23	7.76		
	6	9.05	17.93	4.93		
	7	9.05	12.40	3.41		
	8	9.05	24.99	6.87		
	9	9.05	18.12	4.98		
	10	9.05	22.51	6.19		
NF	1	9.05	16.21	4.46	4.46	1.06
	2	9.05	14.31	3.93		
	3	9.10	13.54	3.66		
	4	9.10	14.69	3.97		
	5	9.05	-	-		
	6	9.10	18.88	5.11		
	7	9.05	24.41	6.71		
	8	9.05	19.07	5.24		
	9	9.05	12.78	3.51		
	10	9.05	12.78	3.51		
NS50	1	9.10	24.22	6.55	5.84	1.25
	2	9.05	15.26	4.20		
	3	9.05	15.83	4.35		
	4	9.05	22.51	6.19		
	5	9.05	20.98	5.77		
	6	9.10	16.40	4.44		
	7	9.10	20.79	5.62		
	8	9.10	28.42	7.69		
	9	9.05	22.13	6.09		
	10	9.05	27.47	7.55		
NS100	1	9.05	16.98	4.67	5.42	1.13
	2	9.05	24.99	6.87		
	3	9.10	15.07	4.08		
	4	9.10	16.59	4.49		
	5	9.10	15.07	4.08		
	6	9.10	23.65	6.40		
	7	9.10	24.80	6.71		
	8	9.10	23.84	6.45		
	9	9.10	17.17	4.64		
	10	9.05	21.17	5.82		
3RHA50	1	9.10	18.50	5.00	5.03	0.85
	2	9.15	16.02	4.26		
	3	9.15	-	-		
	4	9.15	23.84	6.34		
	5	9.15	20.79	5.53		
	6	9.15	20.22	5.38		
	7	9.15	14.88	3.96		
	8	9.15	20.60	5.48		
	9	9.15	14.31	3.81		
	10	9.15	20.79	5.53		

Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
3RHA100	1	9.15	24.41	6.49	4.29	1.03
	2	9.15	13.92	3.70		
	3	9.15	17.17	4.57		
	4	9.15	13.54	3.60		
	5	9.10	18.50	5.00		
	6	9.10	14.31	3.87		
	7	9.15	12.21	3.25		
	8	9.15	17.17	4.57		
	9	9.15	11.25	2.99		
	10	9.15	18.12	4.82		
6RHA50	1	9.10	18.88	5.11	5.25	0.82
	2	9.15	23.08	6.14		
	3	9.15	15.64	4.16		
	4	9.15	16.02	4.26		
	5	9.15	17.17	4.57		
	6	9.15	23.27	6.19		
	7	9.15	20.03	5.33		
	8	9.15	19.07	5.07		
	9	9.10	24.22	6.55		
	10	9.10	19.07	5.16		
6RHA100	1	9.15	20.41	5.43	5.27	1.29
	2	9.15	21.36	5.68		
	3	9.15	22.32	5.94		
	4	9.15	17.93	4.77		
	5	9.15	23.08	6.14		
	6	9.15	14.11	3.75		
	7	9.15	11.63	3.09		
	8	9.15	24.99	6.65		
	9	9.10	26.13	7.07		
	10	9.15	15.64	4.16		
9RHA50	1	9.15	20.41	5.43	4.84	1.12
	2	9.15	19.84	5.28		
	3	9.15	22.51	5.99		
	4	9.20	13.16	3.44		
	5	9.20	24.60	6.44		
	6	9.20	20.60	5.39		
	7	9.20	20.22	5.29		
	8	9.20	15.83	4.14		
	9	9.20	15.26	3.99		
	10	9.20	11.63	3.04		
9RHA100	1	9.20	20.98	5.49	4.53	0.77
	2	9.20	19.65	5.14		
	3	9.20	20.98	5.49		
	4	9.25	18.69	4.81		
	5	9.20	18.88	4.94		
	6	9.20	15.26	3.99		
	7	9.20	16.59	4.34		
	8	9.20	14.31	3.75		
	9	9.20	12.21	3.20		
	10	9.20	15.83	4.14		

Appendix E

Table E-1 Experimental data of modulus of rupture of fired bodies at 900 °C

900 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
NC	1	8.85	59.89	17.61	18.8	2.61
	2	8.80	70.57	21.11		
	3	8.85	64.09	18.85		
	4	8.85	-	-		
	5	8.85	73.62	21.65		
	6	8.85	69.05	20.30		
	7	8.85	46.92	13.80		
	8	8.90	55.12	15.94		
	9	8.85	70.00	20.58		
	10	8.90	68.09	19.69		
NF	1	8.95	84.30	23.97	20.5	3.32
	2	8.95	59.13	16.81		
	3	8.95	79.15	22.50		
	4	8.95	81.63	23.21		
	5	8.90	77.25	22.33		
	6	8.95	49.40	14.04		
	7	8.95	84.30	23.97		
	8	8.95	65.23	18.55		
	9	8.95	69.05	19.63		
	10	8.95	70.00	19.90		
NS50	1	8.95	70.38	20.01	21.9	2.35
	2	8.95	81.83	23.26		
	3	8.95	70.19	19.96		
	4	8.95	80.87	22.99		
	5	9.00	90.41	25.28		
	6	8.95	61.42	17.46		
	7	9.00	73.43	20.53		
	8	8.95	82.59	23.48		
	9	8.95	76.48	21.74		
	10	9.00	85.45	23.89		
NS100	1	8.90	60.84	17.59	20.8	2.60
	2	8.95	85.83	24.40		
	3	8.95	76.87	21.85		
	4	8.90	55.69	16.10		
	5	8.95	69.62	19.79		
	6	9.00	79.35	22.19		
	7	8.95	84.69	24.08		
	8	8.95	70.76	20.12		
	9	8.90	73.24	21.18		
	10	9.00	73.05	20.42		
3RHA50	1	9.05	70.00	19.25	21.0	2.95
	2	9.00	65.61	18.34		
	3	9.05	83.35	22.92		
	4	9.05	67.90	18.67		
	5	9.05	84.88	23.34		
	6	9.05	61.61	16.94		
	7	9.05	88.12	24.23		
	8	9.00	88.12	24.64		
	9	9.05	84.88	23.34		
	10	9.05	65.99	18.15		

900 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
3RHA100	1	9.00	64.85	18.13	18.8	1.80
	2	9.05	67.33	18.51		
	3	9.00	64.47	18.03		
	4	9.05	65.61	18.04		
	5	9.00	60.65	16.96		
	6	9.05	76.29	20.98		
	7	9.05	73.24	20.14		
	8	9.05	75.53	20.77		
	9	9.05	57.60	15.84		
	10	9.05	76.48	21.03		
6RHA50	1	9.00	59.13	16.53	18.7	2.59
	2	9.00	75.91	21.22		
	3	9.00	66.57	18.61		
	4	9.00	54.36	15.20		
	5	9.00	61.61	17.23		
	6	9.05	71.91	19.77		
	7	9.00	73.43	20.53		
	8	9.05	65.61	18.04		
	9	9.05	85.45	23.50		
	10	9.05	58.36	16.05		
6RHA100	1	9.00	78.58	21.97	19.3	2.56
	2	9.05	67.52	18.57		
	3	9.05	59.89	16.47		
	4	9.00	65.42	18.29		
	5	9.05	61.61	16.94		
	6	9.05	77.82	21.40		
	7	9.05	80.49	22.13		
	8	9.05	55.31	15.21		
	9	9.00	75.72	21.17		
	10	9.05	77.44	21.29		
9RHA50	1	9.10	48.64	13.16	17.4	2.26
	2	9.10	72.10	19.50		
	3	9.10	64.47	17.44		
	4	9.15	70.38	18.73		
	5	9.15	68.86	18.32		
	6	9.15	71.91	19.13		
	7	9.15	58.75	15.63		
	8	9.15	71.33	18.98		
	9	9.15	69.62	18.52		
	10	9.10	52.07	14.08		
9RHA100	1	9.15	77.63	20.65	16.8	2.24
	2	9.15	64.09	17.05		
	3	9.15	57.79	15.38		
	4	9.20	62.56	16.38		
	5	9.20	67.14	17.57		
	6	9.15	53.98	14.36		
	7	9.15	65.80	17.51		
	8	9.15	75.53	20.10		
	9	9.15	55.69	14.82		
	10	9.15	53.79	14.31		

Table E-2 Experimental data of modulus of rupture of fired bodies at 950 °C

950 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
NC	1	8.80	98.04	29.32	25.1	7.55
	2	8.80	104.90	31.37		
	3	8.75	59.51	18.11		
	4	8.75	93.27	28.38		
	5	8.80	65.80	19.68		
	6	8.80	74.77	22.36		
	7	8.80	65.99	19.74		
	8	8.80	43.11	12.89		
	9	8.80	112.20	33.56		
	10	8.85	121.10	35.61		
NF	1	8.90	94.60	27.35	23.6	3.34
	2	8.95	84.88	24.13		
	3	8.95	84.30	23.97		
	4	8.95	72.86	20.71		
	5	8.90	76.87	22.22		
	6	9.00	82.21	22.99		
	7	8.95	57.22	16.27		
	8	8.90	85.07	24.60		
	9	8.90	90.98	26.30		
	10	8.90	94.22	27.24		
NS50	1	8.95	98.23	27.93	23.7	2.93
	2	8.95	73.62	20.93		
	3	8.90	79.92	23.11		
	4	8.95	81.25	23.10		
	5	8.90	80.30	23.22		
	6	8.90	69.62	20.13		
	7	8.90	95.37	27.57		
	8	8.90	93.27	26.97		
	9	8.90	69.81	20.18		
	10	8.90	80.87	23.38		
NS100	1	8.85	95.75	28.16	24.2	4.17
	2	8.90	81.83	23.66		
	3	8.90	101.70	29.40		
	4	8.90	78.39	22.66		
	5	8.85	97.66	28.72		
	6	8.90	66.76	19.30		
	7	8.90	97.66	28.24		
	8	8.90	74.39	21.51		
	9	8.90	61.61	17.81		
	10	8.90	78.01	22.55		
3RHA50	1	8.95	72.86	20.71	23.2	2.38
	2	8.95	89.07	25.32		
	3	9.00	91.55	25.60		
	4	8.95	71.72	20.39		
	5	9.00	89.26	24.96		
	6	8.95	87.55	24.89		
	7	8.95	90.60	25.76		
	8	9.00	79.54	22.24		
	9	8.95	77.06	21.91		
	10	9.00	70.76	19.78		

950 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
3RHA100	1	9.00	93.08	26.02	24.1	1.40
	2	9.00	82.02	22.93		
	3	9.05	85.83	23.60		
	4	9.00	90.98	25.44		
	5	9.00	90.60	25.33		
	6	9.05	86.40	23.76		
	7	9.00	76.87	21.49		
	8	9.00	83.16	23.25		
	9	9.00	90.22	25.22		
	10	9.00	85.07	23.78		
6RHA50	1	9.00	76.10	21.28	20.2	2.50
	2	9.00	79.15	22.13		
	3	9.00	78.58	21.97		
	4	9.05	61.61	16.94		
	5	9.00	68.86	19.25		
	6	9.05	71.53	19.67		
	7	9.00	61.04	17.07		
	8	9.05	71.33	19.61		
	9	9.00	90.22	25.22		
	10	9.00	68.28	19.09		
6RHA100	1	9.00	80.30	22.45	19.8	2.82
	2	9.00	53.79	15.04		
	3	8.95	65.61	18.65		
	4	9.00	83.54	23.36		
	5	8.95	68.09	19.36		
	6	9.00	63.51	17.76		
	7	9.00	86.78	24.26		
	8	8.95	68.09	19.36		
	9	8.95	67.71	19.25		
	10	9.00	64.28	17.97		
9RHA50	1	9.05	56.08	15.42	17.0	1.88
	2	9.05	59.89	16.47		
	3	9.05	66.95	18.41		
	4	9.05	62.75	17.26		
	5	9.10	57.03	15.43		
	6	9.10	67.52	18.26		
	7	9.10	53.79	14.55		
	8	9.10	77.82	21.05		
	9	9.10	63.13	17.08		
	10	9.10	60.46	16.35		
9RHA100	1	9.05	68.28	18.78	18.1	1.65
	2	9.10	65.04	17.59		
	3	9.10	67.90	18.37		
	4	9.10	74.58	20.17		
	5	9.10	70.95	19.19		
	6	9.10	66.57	18.01		
	7	9.05	51.88	14.27		
	8	9.10	64.28	17.39		
	9	9.10	73.43	19.86		
	10	9.05	64.85	17.83		

Table E-3 Experimental data of modulus of rupture of fired bodies at 1000 °C

1000 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
NC	1	8.60	98.42	31.54	31.8	6.18
	2	8.65	130.70	41.16		
	3	8.60	112.70	36.11		
	4	8.60	82.21	26.34		
	5	8.60	125.50	40.22		
	6	8.65	84.69	26.67		
	7	8.60	81.25	26.04		
	8	8.60	84.30	27.01		
	9	8.60	82.02	26.28		
	10	8.60	114.40	36.66		
NF	1	8.75	74.77	22.75	22.8	3.38
	2	8.75	74.39	22.63		
	3	8.75	88.50	26.93		
	4	8.70	73.62	22.79		
	5	8.70	77.06	23.85		
	6	8.70	88.69	27.45		
	7	8.70	54.36	16.83		
	8	8.70	82.02	25.39		
	9	8.75	61.04	18.57		
	10	8.70	68.28	21.13		
NS50	1	8.75	78.20	23.79	24.8	3.88
	2	8.70	61.23	18.95		
	3	8.75	93.27	28.38		
	4	8.70	100.10	30.98		
	5	8.75	84.88	25.82		
	6	8.70	81.25	25.15		
	7	8.70	70.76	21.90		
	8	8.70	77.25	23.91		
	9	8.70	64.47	19.95		
	10	8.75	94.41	28.72		
NS100	1	8.70	45.97	14.23	23.7	5.03
	2	8.70	85.83	26.57		
	3	8.75	88.88	27.04		
	4	8.70	69.81	21.61		
	5	8.75	73.62	22.40		
	6	8.75	106.00	32.25		
	7	8.70	76.10	23.55		
	8	8.70	90.22	27.93		
	9	8.70	64.85	20.07		
	10	8.70	67.33	20.84		
3RHA50	1	8.85	64.47	18.96	23.1	3.13
	2	8.85	71.53	21.03		
	3	8.80	79.73	23.85		
	4	8.80	81.06	24.24		
	5	8.85	73.81	21.70		
	6	8.85	66.95	19.69		
	7	8.80	90.03	26.93		
	8	8.85	93.27	27.43		
	9	8.80	68.86	20.60		
	10	8.85	90.03	26.47		

1000 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
3RHA100	1	8.75	79.15	24.08	22.6	2.79
	2	8.80	96.89	28.98		
	3	8.80	73.24	21.91		
	4	8.85	77.82	22.88		
	5	8.80	70.76	21.16		
	6	8.85	64.66	19.01		
	7	8.80	69.81	20.88		
	8	8.80	76.87	22.99		
	9	8.80	79.35	23.73		
	10	8.80	66.57	19.91		
6RHA50	1	8.85	57.41	16.88	19.9	2.24
	2	8.85	67.33	19.80		
	3	8.85	65.80	19.35		
	4	8.85	84.11	24.73		
	5	8.85	71.72	21.09		
	6	8.85	71.72	21.09		
	7	8.85	67.90	19.97		
	8	8.85	69.05	20.30		
	9	8.85	63.32	18.62		
	10	8.85	58.17	17.10		
6RHA100	1	8.90	83.35	24.10	22.0	2.75
	2	8.85	70.76	20.81		
	3	8.85	57.41	16.88		
	4	8.85	79.35	23.33		
	5	8.85	66.38	19.52		
	6	8.85	72.10	21.20		
	7	8.85	69.81	20.53		
	8	8.85	80.30	23.61		
	9	8.85	82.02	24.12		
	10	8.80	87.74	26.24		
9RHA50	1	9.00	73.09	20.44	19.0	1.78
	2	9.00	82.40	23.04		
	3	9.00	67.14	18.77		
	4	9.00	67.33	18.82		
	5	9.00	71.14	19.89		
	6	9.00	62.94	17.60		
	7	8.95	62.56	17.79		
	8	9.00	60.65	16.96		
	9	9.00	64.28	17.97		
	10	9.00	65.42	18.29		
9RHA100	1	8.95	61.42	17.46	18.9	1.91
	2	8.95	73.43	20.88		
	3	9.00	63.90	17.87		
	4	9.00	75.53	21.12		
	5	9.00	75.53	21.12		
	6	9.00	69.62	19.47		
	7	8.95	54.55	15.51		
	8	9.00	63.51	17.76		
	9	9.00	72.29	20.21		
	10	9.00	63.90	17.87		

Table E-4 Experimental data of modulus of rupture of fired mixed bodies at 1050 °C

1050 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
NC	1	8.45	73.24	24.74	31.0	7.77
	2	8.40	95.75	32.93		
	3	8.40	51.12	17.58		
	4	8.40	113.70	39.10		
	5	8.45	120.70	40.77		
	6	8.45	60.46	20.42		
	7	8.40	99.95	34.37		
	8	8.45	105.30	35.57		
	9	8.40	85.83	29.52		
	10	8.35	98.61	34.52		
NF	1	8.60	62.37	19.99	22.5	2.67
	2	8.60	71.14	22.80		
	3	8.55	80.87	26.37		
	4	8.60	62.18	19.93		
	5	8.60	63.32	20.29		
	6	8.60	71.91	23.04		
	7	8.65	81.25	25.59		
	8	8.60	64.85	20.78		
	9	8.55	79.92	26.06		
	10	8.65	63.90	20.12		
NS50	1	8.55	96.70	31.53	30.1	3.67
	2	8.55	101.10	32.97		
	3	8.60	102.40	32.81		
	4	8.60	78.96	25.30		
	5	8.60	84.88	27.20		
	6	8.60	101.70	32.59		
	7	8.60	91.17	29.22		
	8	8.60	111.60	35.76		
	9	8.60	92.12	29.52		
	10	8.60	76.10	24.39		
NS100	1	8.60	76.29	24.45	28.4	4.84
	2	-	-	-		
	3	8.60	104.00	33.33		
	4	8.65	100.10	31.52		
	5	8.60	89.65	28.73		
	6	8.60	75.91	24.33		
	7	8.60	101.30	32.46		
	8	8.60	60.27	19.31		
	9	8.60	87.17	27.93		
	10	8.60	103.20	33.07		
3RHA50	1	8.75	93.08	28.32	22.4	4.63
	2	8.75	85.26	25.94		
	3	8.75	60.46	18.39		
	4	8.70	58.36	18.06		
	5	8.70	91.74	28.40		
	6	8.70	57.60	17.83		
	7	8.75	69.24	21.07		
	8	8.75	70.00	21.30		
	9	8.70	87.93	27.22		
	10	8.75	56.46	17.18		

1050 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
3RHA100	1	8.70	57.79	17.89	23.6	3.83
	2	8.70	79.92	24.74		
	3	8.60	56.65	18.15		
	4	8.70	84.30	26.09		
	5	8.70	90.98	28.16		
	6	8.70	84.11	26.03		
	7	8.70	92.12	28.51		
	8	8.70	66.95	20.72		
	9	8.70	70.41	21.79		
	10	8.70	75.72	23.44		
6RHA50	1	8.75	76.29	23.21	22.5	3.66
	2	8.75	57.98	17.64		
	3	8.70	51.31	15.88		
	4	8.75	74.20	22.58		
	5	8.75	76.87	23.39		
	6	8.75	84.69	25.77		
	7	8.70	83.92	25.98		
	8	8.75	64.47	19.61		
	9	8.75	80.68	24.55		
	10	8.80	88.88	26.58		
6RHA100	1	8.75	59.70	18.16	21.7	2.23
	2	8.75	75.91	23.10		
	3	8.80	76.29	22.82		
	4	8.75	60.65	18.45		
	5	8.70	70.57	21.84		
	6	8.75	63.71	19.38		
	7	8.75	78.20	23.79		
	8	8.80	77.63	23.22		
	9	8.75	74.39	22.63		
	10	8.75	78.96	24.02		
9RHA50	1	8.85	58.17	17.10	17.5	1.47
	2	8.90	65.80	19.02		
	3	8.90	57.79	16.71		
	4	8.90	67.52	19.52		
	5	8.90	56.65	16.38		
	6	8.85	62.94	18.51		
	7	8.85	49.21	14.47		
	8	8.85	58.56	17.22		
	9	8.85	62.37	18.34		
	10	8.85	60.46	17.78		
9RHA100	1	8.90	72.67	21.01	19.4	3.50
	2	8.85	61.23	18.00		
	3	8.85	75.91	22.32		
	4	8.85	56.08	16.49		
	5	8.85	49.40	14.53		
	6	8.80	88.88	26.58		
	7	8.85	68.09	20.02		
	8	8.85	69.43	20.42		
	9	8.85	54.17	15.93		
	10	8.85	65.04	19.12		

Table E-5 Experimental data of modulus of rupture of fired mixed bodies at 1100 °C

1100 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
NC	1	8.35	144.60	50.62	36.1	12.31
	2	8.40	125.50	43.16		
	3	8.35	43.11	15.09		
	4	8.35	120.20	42.08		
	5	8.30	112.70	40.17		
	6	8.35	73.43	25.71		
	7	8.35	123.40	43.20		
	8	8.40	49.21	16.92		
	9	8.35	107.20	37.53		
	10	8.35	128.90	45.13		
NF	1	8.50	87.36	28.99	27.1	5.71
	2	8.50	94.03	31.21		
	3	8.50	46.16	15.32		
	4	8.50	75.15	24.94		
	5	8.50	70.00	23.23		
	6	8.55	75.91	24.75		
	7	8.50	93.84	31.14		
	8	8.55	75.53	24.63		
	9	8.50	94.03	31.21		
	10	8.50	106.80	35.45		
NS50	1	8.50	113.30	37.60	34.7	4.57
	2	8.45	100.30	33.88		
	3	8.55	123.00	40.11		
	4	8.50	83.16	27.60		
	5	8.45	115.80	39.12		
	6	8.45	103.80	35.07		
	7	8.45	108.30	36.59		
	8	8.50	104.00	34.52		
	9	8.50	78.96	26.21		
	10	8.50	110.40	36.64		
NS100	1	8.45	116.30	39.29	32.3	6.05
	2	8.45	85.45	28.87		
	3	8.50	113.70	37.74		
	4	8.50	80.49	26.71		
	5	8.45	87.36	29.51		
	6	8.45	88.69	29.96		
	7	8.50	81.44	27.03		
	8	8.45	97.66	32.99		
	9	8.50	81.83	27.16		
	10	8.45	130.70	44.15		
3RHA50	1	8.65	84.30	26.55	26.4	2.72
	2	8.65	80.11	25.23		
	3	8.65	97.27	30.63		
	4	8.65	69.05	21.75		
	5	8.65	92.89	29.25		
	6	8.70	80.87	25.03		
	7	8.65	81.83	25.77		
	8	8.65	90.60	28.53		
	9	8.65	87.17	27.45		
	10	8.65	74.01	23.31		

1100 °C						
Formula	No.	D (mm)	P (N)	M.O.R. (MPa)	Avg. (MPa)	S.D.
3RHA100	1	8.60	104.10	33.36	29.2	5.06
	2	8.60	109.50	35.09		
	3	8.60	92.12	29.52		
	4	8.60	75.53	24.20		
	5	8.65	68.28	21.50		
	6	8.60	101.10	32.40		
	7	8.60	95.56	30.62		
	8	8.60	70.19	22.49		
	9	8.65	111.60	35.15		
	10	8.60	87.17	27.93		
6RHA50	1	8.70	82.40	25.50	23.5	2.69
	2	8.70	87.93	27.22		
	3	8.70	87.55	27.10		
	4	8.70	69.43	21.49		
	5	8.70	66.18	20.48		
	6	8.60	71.33	22.86		
	7	8.70	63.32	19.60		
	8	8.70	71.91	22.26		
	9	8.70	75.15	23.26		
	10	8.70	82.21	25.45		
6RHA100	1	8.65	75.34	23.73	24.5	2.95
	2	8.70	67.14	20.78		
	3	8.70	68.47	21.19		
	4	8.70	90.41	27.98		
	5	8.70	90.03	27.87		
	6	8.70	84.88	26.27		
	7	8.65	86.02	27.09		
	8	8.65	79.73	25.11		
	9	8.70	79.54	24.62		
	10	8.70	65.04	20.13		
9RHA50	1	8.80	74.96	22.42	22.3	2.85
	2	8.80	71.14	21.28		
	3	8.85	76.87	22.60		
	4	8.80	63.32	18.94		
	5	8.80	86.98	26.01		
	6	8.80	70.19	20.99		
	7	8.80	91.74	27.44		
	8	8.80	79.54	23.79		
	9	8.80	69.81	20.88		
	10	8.80	61.80	18.48		
9RHA100	1	8.75	78.01	23.73	22.5	3.57
	2	8.80	74.20	22.19		
	3	8.80	79.73	23.85		
	4	8.80	59.89	17.91		
	5	8.80	93.84	28.07		
	6	8.80	60.65	18.14		
	7	8.80	86.40	25.84		
	8	8.80	81.63	24.41		
	9	8.75	77.25	23.50		
	10	8.80	58.75	17.57		

Biography

Mr. Prapun Aungatichart was born in 1961, he received his Bachelor's Degree of Engineering in Industrial Engineering from Chulalongkorn University in 1985 and received his Master's Degree of Science in Industrial Technology from Eastern Michigan University, U.S.A., in 1987.

He began to study for his Master's Degree of Science in Ceramic Technology, Department of Materials Science, Chulalongkorn University, in October 2002 and completed his program in December 2004.



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย