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Appendices

Appendix A

Table A-1 Particle size distribution of raw clay

particle sizes (μm)	raw clay wt.%	raw clay wt.% finer than
0.226	0.163	0.163
0.259	0.284	0.447
0.296	0.453	0.900
0.339	0.691	1.591
0.389	1.027	2.618
0.445	1.353	3.971
0.510	1.695	5.666
0.584	1.957	7.623
0.669	2.176	9.799
0.766	2.355	12.154
0.877	2.529	14.683
1.005	2.808	17.491
1.151	3.064	20.555
1.318	3.588	24.143
1.510	4.103	28.246
1.729	4.596	32.842
1.981	5.191	38.033
2.269	5.691	43.724
2.599	6.141	49.865
2.976	6.514	56.379
3.409	6.866	63.245
3.905	7.082	70.327
4.472	7.009	77.336
5.122	6.688	84.024
5.867	5.454	89.478
6.720	4.075	93.553
7.697	2.738	96.291
8.816	2.301	98.592
10.097	0.920	99.512
11.565	0.366	99.878
13.246	0.122	100.000
15.172	0.000	100.000
17.377	0.000	100.000
19.904	0.000	100.000

Table A-2 Particle size distribution of sand and grog

sieve no.	particle size (μm)	sand wt.%	grog wt.%
over 20 mesh	> 850	2.7	11.4
20 - 35 mesh	850 - 500	33.5	24.9
35 - 50 mesh	500 - 300	37.7	22.2
50 - 100 mesh	300 - 150	21.6	15.1
100 - 140 mesh	150 - 106	2.2	4.1
140 - 200 mesh	106 - 75	0.9	4.0
200 - 230 mesh	75 - 63	0.3	2.0
230 - 325 mesh	63 - 45	0.3	3.2
under 325 mesh	< 45	0.8	13.0

Table A-3 Water content of raw materials

<table>
<tr><th>materials</th><th>wt. (g)</th><th>dried wt. (g)</th><th>water content (%)</th><th>ave</th><th>stdev</th></tr>
<tr><td>raw clay 1</td><td>108.1</td><td>88.9</td><td>17.8</td><td rowspan="6">20.7</td><td rowspan="6">2.0</td></tr>
<tr><td>raw clay 2</td><td>114.2</td><td>92.4</td><td>19.0</td></tr>
<tr><td>raw clay 3</td><td>110.4</td><td>84.4</td><td>23.5</td></tr>
<tr><td>raw clay 4</td><td>104.6</td><td>82.0</td><td>21.6</td></tr>
<tr><td>raw clay 5</td><td>107.7</td><td>84.9</td><td>21.1</td></tr>
<tr><td>raw clay 6</td><td>104.4</td><td>82.4</td><td>21.1</td></tr>
<tr><td>sand</td><td>100.0</td><td>94.0</td><td>6.0</td><td>6.0</td><td>-</td></tr>
<tr><td>grog</td><td>100.0</td><td>95.7</td><td>4.3</td><td>4.3</td><td>-</td></tr>
</table>

Appendix B

Table B-1 Linear drying shrinkage (%)

conditions	L drying shrinkage (%)	conditions	L drying shrinkage (%)
mixed clay1	5.1	grog 10%	4.8
mixed clay2	5.5	grog 12%	4.3
sand 10%	5.0	grog #50	4.7
sand 15%	4.6	grog #100	4.4
sand #50	4.9	S50G5	6.2
sand #100	4.9	SGG	5.8

Table B-2 Linear firing shrinkage (%)

temperature°C	mixed clay 1	mixed clay 2		
900	1.1	1.1		
950	1.9	1.9		
1000	3.3	3.2		
1050	4.6	4.5		
1100	5.0	5.2		
	CaO 1%	**S50G5**	**SGG**	
850	1.0	0.5	0.7	
900	1.8	0.9	1.2	
950	3.0	2.0	2.4	
1000	4.3	3.4	3.7	
1050	5.2	4.7	4.7	
1100	5.3	4.9	4.9	
	sand 10%	**sand 15%**	**sand #50**	**sand #100**
900	0.8	0.5	0.9	1.0
950	1.5	1.2	1.8	1.8
1000	2.8	2.4	3.2	3.3
1050	4.1	3.4	4.6	4.8
1100	4.4	3.7	5.1	5.3
	grog 10%	**grog 12%**	**grog #50**	**grog #100**
900	1.1	1.0	1.0	1.1
950	1.8	1.7	1.9	1.8
1000	3.2	3.2	3.3	3.3
1050	4.5	4.5	4.6	4.7
1100	5.0	5.0	5.1	5.2
	glass2%	**glass4%**	**glass6%**	**glass8%**
850	0.7	0.8	1.0	1.1
900	1.3	1.4	1.7	2.1
950	2.3	2.7	2.9	3.2
1000	3.9	3.9	4.1	4.5
1050	5.0	5.1	5.1	5.1
1100	5.3	5.3	5.2	5.2

Appendix C

Table C-1 Water absorption (w.a. %) and bulk density (b.d. g/cm^3)

temperature °C	mixed clay 1 (hand mixing)		mixed clay 1 (machine mixing)		mixed clay 2			
	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.		
900	14.9	1.9	14.5	2.0	14.6	1.9		
950	13.7	2.0	13.6	2.0	13.6	2.0		
1000	11.6	2.0	11.2	2.1	11.5	2.0		
1050	9.1	2.1	7.6	2.2	9.0	2.1		
1100	7.4	2.2	5.4	2.3	7.4	2.2		
	Sand 10%		**Sand 15%**		**Sand #50**		**Sand #100**	
	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.
900	14.3	1.9	14.4	1.9	14.2	1.9	14.2	2.0
950	13.3	2.0	13.5	2.0	13.1	2.0	13.0	2.0
1000	11.2	2.1	12.1	2.0	10.3	2.1	10.1	2.1
1050	9.3	2.1	10.0	2.1	7.6	2.2	7.0	2.2
1100	7.7	2.2	7.8	2.1	5.8	2.2	5.5	2.2
	Grog 10%		**Grog 12%**		**Grog #50**		**Grog #100**	
	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.
900	14.7	1.9	15.1	1.9	14.4	1.9	14.1	2.0
950	14.1	2.0	14.1	2.0	13.7	2.0	13.1	2.0
1000	11.8	2.0	12.1	2.0	10.9	2.1	10.2	2.1
1050	9.3	2.1	9.5	2.1	8.4	2.2	7.6	2.2
1100	7.8	2.2	8.2	2.1	7.5	2.2	6.0	2.2
	NaO 3%		**CaO 1%**		**S50G5**		**SGG**	
	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.
850	11.7	2.0	14.1	1.9	13.3	2.0	12.4	2.0
900	9.6	2.1	13.3	2.0	13.2	2.0	11.9	2.0
950	8.0	2.1	10.4	2.1	11.7	2.0	9.6	2.1
1000	4.8	2.2	6.1	2.2	8.8	2.1	6.9	2.2
1050	4.0	2.2	4.5	2.3	5.9	2.2	4.8	2.3
1100			4.1	2.2	4.0	2.3	3.7	2.3
	glass2%		**glass4%**		**glass6%**		**glass8%**	
	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.	w.a.	b.d.
850	13.3	2.0	13.1	2.0	12.5	2.0	12.1	2.0
900	13.0	2.0	12.6	2.0	11.9	2.0	11.5	2.0
950	11.5	2.1	10.8	2.1	9.8	2.1	8.9	2.1
1000	8.4	2.2	7.7	2.2	7.3	2.2	6.4	2.2
1050	6.1	2.2	5.7	2.2	5.3	2.3	5.3	2.3
1100	4.8	2.3	4.6	2.3	4.7	2.3	4.7	2.3

Appendix D

Table D-1 Bending strength (MPa)

temperature °C	mixed clay 1 (hand mixing)		mixed clay 1 (machine mixing)		mixed clay 2			
	MPa	stdev	MPa	stdev	MPa	stdev		
900	19.6	3.2	25.2	3.0	23.1	2.1		
950	18.4	2.8	25.5	5.0	24.4	3.5		
1000	19.9	2.2	26.0	4.4	25.4	2.4		
1050	19.5	4.8	26.0	6.5	25.2	5.5		
1100	23.0	3.6	33.6	5.2	34.2	5.9		
	Sand 10%		**Sand 15%**		**Sand #50**		**Sand #100**	
	MPa	stdev	MPa	stdev	MPa	stdev	MPa	stdev
900	16.2	1.5	12.6	1.4	20.8	2.4	21.8	2.4
950	15.7	1.7	13.1	1.2	22.9	2.6	23.4	3.0
1000	18.7	2.4	12.8	1.7	23.6	3.4	24.9	3.0
1050	16.7	2.0	12.9	1.9	26.6	2.6	27.2	3.5
1100	18.2	2.9	14.0	1.9	31.0	5.9	32.0	7.9
	Grog 10%		**Grog 12%**		**Grog #50**		**Grog #100**	
	MPa	stdev	MPa	stdev	MPa	stdev	MPa	stdev
900	16.7	2.8	16.0	2.2	19.4	1.8	19.2	3.0
950	19.3	2.5	17.1	2.4	19.7	2.9	20.9	3.3
1000	20.7	2.2	17.3	1.7	22.0	3.0	21.1	4.9
1050	19.3	2.1	18.6	1.8	20.2	2.6	20.8	2.7
1100	22.3	2.8	20.4	2.2	23.5	3.4	25.1	3.1
	NaO 3%		**CaO 1%**		**S50G5**		**SGG**	
	MPa	stdev	MPa	stdev	MPa	stdev	MPa	stdev
850	13.3	1.3	19.7	3.4	22.7	2.6	23.4	3.1
900	12.8	1.3	21.9	2.9	23.8	3.2	23.9	3.8
950	12.8	1.4	21.0	3.8	26.8	4.8	28.9	3.2
1000	17.1	2.9	21.0	2.4	26.7	5.0	24.6	3.9
1050	14.3	3.3	25.7	5.8	27.4	5.8	25.8	2.8
1100			24.3	4.6	32.5	4.4	32.9	4.4
	glass2%		**glass4%**		**glass6%**		**glass8%**	
	MPa	stdev	MPa	stdev	MPa	stdev	MPa	stdev
850	18.4	4.4	20.2	3.9	21.8	3.0	20.4	4.3
900	22.0	4.5	22.7	3.7	24.2	4.0	23.1	3.0
950	24.1	3.7	24.7	3.7	25.0	3.6	23.7	2.4
1000	23.9	3.0	24.1	4.4	23.8	2.7	25.5	3.2
1050	24.3	6.6	24.8	4.9	25.2	5.4	25.6	4.1
1100	28.0	5.7	30.0	6.3	26.6	6.3	26.8	4.5

Appendix E

Table E-1 Capillary pore volume (ml/g)

pore diameter (nm)	capillary pore volume (ml/g)						
	SM 1	**SM 2**	**Portugal**	**German**	**S50G5**	**SGG**	**SGG 950°C**
under 6	0.00269	0.00296	0.00049	0.00025	0.00042	0.00109	0.00047
6 - 8	0.00242	0.00270	0.00022	0.00011	0.00021	0.00078	0.00021
8 - 10	0.00299	0.00322	0.00017	0.00008	0.00033	0.00105	0.00021
10 - 12	0.00399	0.00424	0.00019	0.00007	0.00071	0.00146	0.00027
12 - 16	0.00691	0.00789	0.00028	0.00009	0.00128	0.00287	0.00050
16 - 20	0.00886	0.00868	0.00036	0.00008	0.00240	0.00407	0.00073
20 - 80	0.04716	0.04933	0.00560	0.00046	0.02401	0.02958	0.01055
over 80	0.00685	0.01137	0.00639	0.00030	0.05418	0.00825	0.00693
total	**0.08187**	**0.09039**	**0.01370**	**0.00144**	**0.08354**	**0.04915**	**0.01987**

BIOGRAPHY

Mr. Punyoot Huantanom was born in Rayong on 31st July 1980. He received a Bachelor's Degree with 2nd Class Honors in Physics from Faculty of Science, Srinakharinwirot University in 2002. He continued studying for Master's Degree in the field of Ceramic Technology at Chulalongkorn University and graduated in December 2004.