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Appendices

Table	Page
1. Calculated phase composition of FG and NG.	150
2. Calculated phase composition of the β -HH from calcined FG and NG at various temperatures and times.	150
3. Calculated phase composition of the anhydrite from calcined FG and NG at various temperatures and times.	151
4. Particle size of β -HH from the calculation (Blaine).	152
5. Particle size of anhydrite from the calculation (Blaine).	152
6. Effect of CaCl_2 on the calculated phase composition of β -HH.	153
7. Phase composition of the reproduction of β -HH and anhydrites.	153
8. Calculated phase composition of MP prepared from bulk materials (B, P 50x50x50 mm., NG 2.36–3.35 mm.).	154
9. Calculated phase composition of MP prepared from bulk materials (B, P 50x50x10 mm., NG 4.75–5.60 mm.).	155
10. Effect of additives on the physical properties of gypsum specimens prepared from β -HH powder.	156
11. Effect of additives on the physical properties of gypsum board specimens prepared from MP.	157
12. Effect of grinding time on the particle size of MP prepared from bulk materials (density of B = $2.60 \pm 0.03 \text{ g/cm}^3$, P = $2.64 \pm 0.04 \text{ g/cm}^3$ and NG = $2.79 \pm 0.04 \text{ g/cm}^3$) and from mixing 45 wt% β -HH, 5 wt% AIII and 50 wt% AII powders (density of mixed phase powder prepared from FG = $2.57 \pm 0.03 \text{ g/cm}^3$ and NG = $2.73 \pm 0.05 \text{ g/cm}^3$).	158
13. Particle size distribution of MP by centrifugal particle size analyzer.	159
14. Effect of the content of methylcellulose on physical properties of MP prepared from bulk materials and mixed phase composition.	159

Table	Page
15. Effect of the content of additives on the viscosity and setting time of projection plaster (humidity = 72%, room and water temperatures = 33°C and 30°C, pH of water = 7.74 and W/P = 0.60).	160
16. Effect of the content of additives on surface coverage and surface hardness of projection plaster (humidity = 72%, room and water temperatures = 33°C and 30°C, pH of water = 7.74 and W/P=0.60).	161
17. Effect of the content of additives on physical properties of projection plaster (humidity = 68%, room and water temperatures = 34°C and 31°C, pH of water = 7.56 and W/P = 0.60).	162
18. Effect of the content of vinyl acetate on viscosity and setting time of the modified projection plaster (humidity = 69%, room and water temperatures = 34°C and 30°C, pH of water = 7.63 and W/P=0.60).	163
19. Effect of the content of vinyl acetate on surface coverage and surface hardness of the modified projection plaster (humidity = 69%, room and water temperatures = 34°C and 30°C, pH of water = 7.63 and W/P=0.60).	164
20. Effect of the content of vinyl acetate on physical properties of the modified projection plaster (humidity = 76%, room and water temperatures = 33°C and 30°C, pH of water = 7.27 and W/P = 0.60).	165

Table 1 Calculated phase composition of FG and NG.

Materials	%AIII	%HH	%AII	%DH	%Rest
FG (as received)	1.78±1.65	-8.17±2.53	-6.43±2.73	93.33±2.93	6.67±2.81
FG (washed)	-2.08±1.98	-12.08±2.17	-0.09±2.48	95.55±2.81	4.45±2.56
NG	-1.75±2.15	-6.82±1.86	-2.63±3.12	80.07±2.95	19.93±2.97

* The number of test sample was 5.

Table 2 Calculated phase composition of the β -HH from calcined FG and NG at various temperatures and times.

Temperature (°C)	Time (hours.)	%AIII		%HH		%AII		%DH		%Rest	
		FG	NG	FG	NG	FG	NG	FG	NG	FG	NG
120	2	15.34±1.87	9.02±4.03	62.37±2.63	60.17±1.98	4.77±2.28	0.77±0.45	13.07±1.65	10.11±3.14	4.45±2.28	19.93±2.97
120	3	8.71±2.63	8.70±1.86	69.42±1.83	63.32±2.35	7.91±2.45	0.89±0.76	9.51±3.07	7.16±2.67	4.45±2.28	19.93±2.97
120	4	3.72±2.54	2.66±2.26	76.00±3.24	70.87±3.48	8.21±3.01	0.94±0.90	7.62±2.64	5.60±2.41	4.45±2.28	19.93±2.97
130	2	10.68±2.03	7.45±3.21	78.65±4.01	70.76±1.32	5.55±2.81	1.07±0.87	0.67±0.65	0.79±0.21	4.45±2.28	19.93±2.97
130	3	3.22±1.78	6.19±3.09	83.11±3.63	72.52±2.04	8.97±2.04	0.99±0.62	0.25±0.83	0.37±0.25	4.45±2.28	19.93±2.97
130	4	1.36±1.14	2.87±1.64	87.42±2.43	75.89±3.36	6.23±1.83	1.21±1.13	0.54±0.18	0.10±0.23	4.45±2.28	19.93±2.97
150	2	23.93±1.85	14.00±3.21	59.01±3.02	52.40±1.87	11.73±2.75	12.55±1.04	0.88±1.13	1.12±1.00	4.45±2.28	19.93±2.97
150	3	16.61±1.93	11.27±2.78	63.64±2.78	56.99±1.14	14.68±3.13	10.14±2.17	0.62±0.98	0.87±0.76	4.45±2.28	19.93±2.97
150	4	12.75±2.14	11.04±2.04	68.84±1.65	60.66±1.35	13.22±1.64	7.97±3.02	0.74±1.12	0.40±0.65	4.45±2.28	19.93±2.97

* The number of test sample was 5.

Table 3 Calculated phase composition of the anhydrite from calcined FG and NG at various temperatures and times.

Temperature (°C)	Time (hours.)	%AIII		%HH		%AII		%DH		%Rest	
		FG	NG	FG	NG	FG	NG	FG	NG	FG	NG
400	2	83.62±2.75	73.41±2.32	1.75±1.13	1.56±1.15	10.18±2.46	5.10±2.43	-1.71±1.58	-2.13±1.14	4.45±2.28	19.93±2.97
400	3	83.13±2.93	71.89±1.76	1.47±1.25	1.33±0.98	10.95±1.87	6.85±2.65	-2.22±2.14	-1.69±1.34	4.45±2.28	19.93±2.97
400	4	82.26±1.63	71.10±1.95	1.09±0.96	1.19±1.03	12.20±1.65	7.78±3.17	-1.09±0.94	-0.85±0.76	4.45±2.28	19.93±2.97
450	2	82.11±2.45	70.60±2.11	0.71±0.85	0.85±0.61	12.73±2.38	8.62±2.73	-1.24±1.76	-2.35±1.78	4.45±2.28	19.93±2.97
450	3	81.79±3.14	69.15±3.21	0.63±0.57	0.54±0.78	13.74±2.74	10.38±2.67	-2.01±1.84	-1.53±1.20	4.45±2.28	19.93±2.97
450	4	81.44±1.65	68.53±1.18	0.67±0.32	0.42±0.57	13.44±2.93	11.12±1.97	-0.86±0.75	-1.94±0.98	4.45±2.28	19.93±2.97
500	2	80.61±3.47	67.63±2.24	0.44±0.92	0.28±0.15	14.50±3.21	12.16±2.93	-1.47±1.09	-2.01±1.45	4.45±2.28	19.93±2.97
500	3	79.24±2.64	65.09±2.37	0.33±0.20	0.15±0.21	15.98±2.41	14.83±2.36	-1.81±1.74	-1.32±1.14	4.45±2.28	19.93±2.97
500	4	78.19±2.07	63.48±2.76	0.13±0.11	0.75±0.66	17.23±1.87	15.84±1.87	-2.23±2.11	-1.21±1.09	4.45±2.28	19.93±2.97
550	2	77.16±2.14	62.90±1.76	0.09±0.07	0.06±0.14	18.30±3.42	17.12±3.23	-1.51±1.42	-0.97±0.84	4.45±2.28	19.93±2.97
550	3	75.96±2.36	61.98±3.45	0.01±0.02	0.02±0.07	19.58±2.63	18.07±1.47	-1.13±1.07	-1.15±0.79	4.45±2.28	19.93±2.97
550	4	75.19±1.86	60.78±2.51	0.01±0.14	-2.08±1.63	20.35±2.59	19.26±2.53	-0.87±0.45	-1.99±1.65	4.45±2.28	19.93±2.97
600	2	74.10±2.05	57.52±2.30	-1.57±1.24	-1.77±1.87	21.45±1.69	22.55±2.41	-2.07±1.68	-1.83±1.07	4.45±2.28	19.93±2.97
600	3	72.80±2.33	55.05±1.87	-2.83±2.03	-3.03±2.01	22.75±3.15	25.02±2.83	-1.60±1.47	-1.06±0.75	4.45±2.28	19.93±2.97
600	4	70.67±1.98	53.85±2.25	-1.56±1.21	-1.08±1.01	24.88±1.73	26.22±1.76	-0.96±0.85	-1.65±1.23	4.45±2.28	19.93±2.97

* The number of test sample was 5.

Table 4 Particle size of β -HH from the calculation (Blaine).
(data for Fig. 4.11)

T (°C)	t (hours)	Specific surface area ($1 \times 10^{-4} \text{ m}^2/\text{g}$)		Density (g/cm^3)		Mean particle size from calculation (μm)	
		FG	NG	FG	NG	FG	NG
120	2	4789.63±26.42	2325.17±17.25	2.40±0.02	2.59±0.03	5.22±0.15	9.96±0.21
120	3	4621.10±35.50	2278.93±20.38	2.40±0.01	2.60±0.02	5.41±0.24	10.13±0.28
120	4	4662.27±18.13	2191.84±24.69	2.41±0.05	2.60±0.03	5.34±0.21	10.53±0.13
130	2	4403.54±22.28	2370.50±15.01	2.42±0.04	2.61±0.03	5.63±0.10	10.46±0.16
130	3	4551.32±19.67	2122.07±21.26	2.41±0.04	2.62±0.02	5.47±0.19	10.79±0.11
130	4	4192.66±30.45	2229.01±16.33	2.43±0.02	2.62±0.02	5.89±0.23	10.27±0.23
150	2	3947.48±19.94	2258.74±22.29	2.42±0.03	2.62±0.01	6.28±0.27	10.98±0.22
150	3	3985.19±25.07	2078.49±25.86	2.44±0.03	2.61±0.05	6.17±0.19	11.06±0.28
150	4	3862.75±32.11	2049.66±29.51	2.42±0.02	2.63±0.04	6.42±0.25	11.13±0.20

* The number of test sample was 5, T = temperature, t = time.

Table 5 Particle size of anhydrite from the calculation (Blaine).
(data for Fig. 4.11)

T (°C)	t (hours)	Specific surface area ($1 \times 10^{-4} \text{ m}^2/\text{g}$)		Density (g/cm^3)		Mean particle size from calculation (μm)	
		FG	NG	FG	NG	FG	NG
400	2	1446.34±25.07	1053.56±15.85	2.41±0.02	2.62±0.06	17.21±0.12	21.74±0.20
400	3	1405.07±39.47	1034.31±22.43	2.45±0.04	2.64±0.03	17.43±0.25	21.96±0.15
400	4	1399.86±11.16	1040.42±20.20	2.43±0.06	2.61±0.02	17.64±0.17	22.10±0.18
450	2	1372.19±27.03	1001.63±35.19	2.47±0.01	2.67±0.06	17.70±0.15	22.44±0.14
450	3	1374.23±25.49	1014.47±27.57	2.49±0.05	2.65±0.05	17.53±0.11	22.32±0.20
450	4	1350.58±20.58	1042.81±24.63	2.50±0.03	2.69±0.01	17.77±0.19	22.21±0.26
500	2	1345.91±31.20	983.65±36.48	2.53±0.06	2.71±0.02	17.63±0.29	22.51±0.19
500	3	1305.76±16.13	968.32±18.79	2.56±0.07	2.74±0.02	17.95±0.31	22.60±0.24
500	4	1335.21±19.24	963.21±26.65	2.52±0.02	2.75±0.03	17.83±0.24	22.65±0.21
550	2	1294.80±24.65	958.59±28.02	2.55±0.03	2.79±0.05	18.17±0.26	22.43±0.19
550	3	1289.53±32.51	955.43±32.47	2.54±0.03	2.76±0.07	18.32±0.27	22.75±0.27
550	4	1261.64±24.26	953.12±35.65	2.57±0.05	2.78±0.02	18.50±0.16	22.63±0.23
600	2	1239.61±30.66	947.04±21.34	2.58±0.05	2.77±0.03	18.76±0.21	22.86±0.14
600	3	1252.88±27.90	929.66±19.70	2.60±0.04	2.81±0.04	18.43±0.17	22.97±0.20
600	4	1211.26±28.31	927.75±34.55	2.61±0.04	2.80±0.05	18.98±0.31	23.11±0.27

* The number of test sample was 5, T = temperature, t = time.

Table 6 Effect of CaCl₂ on the calculated phase composition of β-HH.

Exposed to air	CaCl ₂ (wt%)	%AIII		%HH		%AII		%DH		%Rest	
		FG	NG	FG	NG	FG	NG	FG	NG	FG	NG
1 hour	-	3.46±1.13	2.76±1.47	86.46±1.84	75.60±2.45	4.76±1.23	1.03±0.75	0.87±0.27	0.68±0.39	4.45±2.28	19.93±2.97
	0.05	5.60±1.58	3.24±2.38	87.11±2.65	74.04±1.93	2.83±1.25	2.78±1.35	0.02±0.13	0.01±0.28	4.45±2.28	19.93±2.97
	0.10	2.96±2.01	1.16±1.06	87.14±1.83	78.01±2.86	5.44±1.63	0.90±1.11	0.01±0.64	-9.76±2.97	4.45±2.28	19.93±2.97
	0.15	6.41±2.53	2.86±2.33	85.04±2.48	76.14±1.57	4.01±1.84	1.07±0.78	-3.52±1.14	-4.25±3.14	4.45±2.28	19.93±2.97
	0.20	2.11±1.79	1.45±1.24	88.01±3.17	77.74±2.15	5.43±2.01	0.88±0.73	-6.02±2.86	-9.61±2.66	4.45±2.28	19.93±2.97
1 day	-	4.55±2.45	2.14±1.65	86.86±2.63	75.42±2.75	1.41±0.97	0.21±0.35	2.73±1.25	2.30±1.03	4.45±2.28	19.93±2.97
	0.05	5.32±2.63	1.98±1.33	85.23±2.15	76.05±2.47	2.89±1.21	0.17±0.14	2.11±1.46	1.87±0.94	4.45±2.28	19.93±2.97
	0.10	4.07±2.35	1.87±1.16	87.01±2.14	75.67±1.63	2.91±1.63	1.02±0.53	1.56±0.75	1.51±1.03	4.45±2.28	19.93±2.97
	0.15	6.72±1.93	2.90±2.06	85.14±3.06	74.90±2.76	2.84±1.78	1.53±0.93	0.85±0.63	0.74±0.65	4.45±2.28	19.93±2.97
	0.20	5.07±2.96	1.99±1.61	87.23±1.98	77.14±3.15	3.24±2.01	0.92±0.87	0.01±0.28	0.01±0.17	4.45±2.28	19.93±2.97
3 days	-	4.32±2.04	2.75±1.63	77.24±3.54	65.14±2.23	1.81±1.53	0.72±0.68	12.18±2.76	12.18±2.76	4.45±2.28	19.93±2.97
	0.05	3.67±1.75	4.30±2.74	81.01±2.38	65.99±3.11	1.92±0.98	1.58±0.96	8.95±3.16	8.95±3.16	4.45±2.28	19.93±2.97
	0.10	4.70±2.13	3.16±1.58	79.65±2.61	67.17±2.47	3.08±2.76	3.08±2.76	8.12±2.07	8.12±2.07	4.45±2.28	19.93±2.97
	0.15	6.92±2.96	5.38±2.76	79.86±3.61	66.98±2.78	2.06±1.43	2.06±1.43	6.71±2.54	6.71±2.54	4.45±2.28	19.93±2.97
	0.20	6.46±2.03	5.22±2.43	80.76±2.83	68.53±3.45	5.01±2.11	5.01±2.11	3.32±1.63	3.32±1.63	4.45±2.28	19.93±2.97

* The number of test sample was 5.

Table 7 Phase composition of the reproduction of β-HH and anhydrites.

Samples	T (°C)	t (hours)	CaCl ₂ (wt%)	%AIII	%HH	%AII	%DH	%Rest
β-HH	130	4	0.15	8.86±3.12	82.31±3.01	4.38±2.53	-3.01±2.81	4.45±2.28
				6.57±3.65	72.12±4.11	1.38±2.14	-3.57±2.57	19.93±2.97
				71.96±2.09	-2.47±2.13	23.59±2.54	-2.11±1.83	4.45±2.28
Anhydrite	600	2	0.15	58.97±3.47	-2.54±1.17	21.10±2.56	-2.36±2.14	19.93±2.97
				58.97±3.47	-2.54±1.17	21.10±2.56	-2.36±2.14	19.93±2.97

* The number of test sample was 5, T = Temperature and t = time.

Table 8 Calculated phase composition of MP prepared from bulk materials (B, P 50x50x50 mm., NG 2.36-3.35 mm.). (data for Fig. 4.22)

Samples	T (°C)	t (hours)	%AIII			%HH			%AII			%DH		
			B	P	NG	B	P	NG	B	P	NG	B	P	NG
1	300	1	6.08±2.15	8.70±2.17	3.77±2.50	70.87±1.50	65.05±1.84	76.49±1.84	23.14±2.23	26.24±2.85	19.74±2.85	-6.78±2.34	-4.67±2.13	-8.93±2.13
2	300	2	7.90±2.37	9.33±2.38	5.03±2.76	66.21±1.94	61.78±1.91	71.77±1.91	25.89±2.06	28.89±3.06	23.20±3.06	-3.14±2.01	-3.69±2.75	-5.14±2.75
3	300	3	8.50±2.01	10.24±0.95	7.24±2.38	61.90±3.01	58.57±2.47	68.42±2.47	29.60±0.74	31.19±2.17	24.34±2.17	-10.03±3.75	-7.87±1.69	-6.73±1.69
4	350	1	10.91±2.65	12.90±1.60	9.44±1.29	57.63±3.15	50.35±2.33	63.84±2.33	31.46±2.39	36.75±2.29	26.72±2.29	-2.65±1.54	-10.13±1.37	-3.08±1.37
5	350	2	12.58±0.93	13.86±1.49	10.02±0.78	53.10±2.78	46.57±2.61	61.10±2.61	34.32±2.64	39.57±0.87	28.88±0.87	-5.78±1.63	-5.40±0.98	-10.15±0.98
6	350	3	13.40±2.78	14.46±2.28	10.76±1.54	50.71±0.69	43.76±0.76	55.97±0.76	35.89±1.73	41.78±2.91	33.27±2.91	-7.74±2.12	-1.78±1.02	-5.02±2.02
7	400	1	14.89±1.64	15.22±2.37	12.20±1.13	46.95±2.84	39.03±1.90	51.42±1.90	38.16±1.12	45.75±2.80	36.38±2.80	-1.98±0.48	-2.65±1.41	-7.13±1.41
8	400	2	15.11±1.50	16.89±3.14	13.80±3.07	42.02±2.21	35.87±2.13	47.76±2.13	42.87±1.55	47.24±2.53	38.44±2.53	-3.65±1.54	-5.28±2.63	-1.60±1.03
9	400	3	16.23±2.65	18.37±2.70	15.25±2.38	38.16±2.13	32.75±2.84	43.72±2.84	45.61±2.64	48.88±3.42	41.03±3.42	-6.37±2.02	-5.30±3.10	-2.23±1.10
10	450	1	17.95±3.02	21.43±2.41	15.87±2.49	32.65±2.47	29.64±2.79	40.88±2.79	49.40±2.53	48.93±1.49	43.25±1.49	-11.14±2.85	-3.32±2.58	-9.75±2.58
11	450	2	19.11±2.40	23.69±2.52	16.40±1.62	30.00±1.98	26.25±2.50	35.76±2.50	50.89±2.81	50.06±1.37	47.84±1.37	-9.63±2.13	-2.10±2.97	-7.21±2.97
12	450	3	21.37±2.57	24.64±1.77	18.17±1.57	27.47±1.63	22.74±1.66	32.73±1.66	51.16±3.14	52.62±2.65	49.01±2.65	-8.02±2.60	-1.81±2.60	-5.08±2.60
13	500	1	24.38±3.11	25.86±3.14	21.12±0.98	22.28±2.24	18.93±2.32	28.28±2.32	53.34±2.22	55.75±1.77	50.60±1.77	-3.11±1.48	-9.64±1.83	-4.79±1.83
14	500	2	25.71±2.98	24.44±2.69	23.69±2.01	19.84±2.52	16.28±1.61	25.09±1.61	54.45±2.76	59.28±2.33	51.22±2.33	-5.52±1.21	-11.13±0.75	-6.65±0.75
15	500	3	27.87±0.73	22.28±1.73	22.83±2.76	13.61±3.07	13.91±2.40	22.84±2.40	58.52±2.38	63.81±2.10	54.33±2.10	-4.98±2.34	-7.43±1.86	-10.11±1.86
16	550	1	24.48±1.47	20.74±1.02	20.96±3.14	10.27±2.67	9.86±0.77	17.85±0.77	65.25±1.69	69.40±2.45	61.19±2.45	-2.63±1.09	-6.41±2.59	-2.23±1.59
17	550	2	22.72±1.69	18.36±2.80	18.00±0.67	7.34±2.30	4.93±2.84	14.28±2.84	69.94±1.93	76.71±3.07	67.72±3.07	-8.07±3.11	-8.54±2.32	-3.65±2.32
18	550	3	21.57±2.20	16.62±2.21	16.22±2.76	3.71±2.15	1.59±2.63	10.71±2.63	74.72±0.89	81.79±2.39	73.07±2.39	-7.15±2.20	-3.60±0.60	-8.22±0.60

* the number of each sample was 5, T = temperature, t = time.

Table 9 Calculated phase composition of MP prepare from bulk materials (B, P 50x50x10 mm., NG 4.75–5.60 mm.). (data for Fig. 4.22)

Samples	T (°C)	t (hours)	%AIII	%HH	%AII	%DH
B	350	3	7.85±2.75	59.28±2.03	32.87±2.61	-6.24±1.90
	400	1	9.07±2.69	54.31±1.45	36.80±2.29	-5.43±1.63
	400	2	10.38±3.11	50.71±2.50	38.91±1.79	-1.49±1.27
	400	3	10.96±2.94	47.17±2.78	41.90±1.54	-2.07±1.69
	450	1	12.11±2.87	42.58±1.91	45.31±3.01	-8.31±2.14
	P	350	1	8.36±2.13	57.87±1.65	33.77±1.19
350		2	10.07±2.74	53.63±1.93	36.30±2.76	-4.65±2.02
350		3	10.85±2.86	50.81±2.04	38.34±2.49	-7.14±1.64
400		1	12.23±3.20	47.90±2.75	39.87±1.86	-2.03±0.63
400		2	13.07±2.89	43.41±2.38	43.52±2.53	-3.81±2.84
NG		400	1	5.64±2.53	60.56±2.85	33.98±3.01
	400	2	6.78±2.64	57.98±3.09	35.24±2.76	-1.58±1.33
	400	2	7.85±2.20	53.82±1.81	38.33±1.99	-6.63±2.57
	450	1	8.57±1.93	51.28±2.71	40.15±2.70	-7.85±1.74
	450	2	10.50±1.76	47.53±2.14	41.97±3.15	-4.56±2.04
	450	3	11.28±3.12	44.42±2.90	44.30±2.44	-10.19±1.88

* the number of each sample was 5, T = Temperature, t = Time.

Table 10 Effect of additives on the physical properties of gypsum specimens prepared from β -HH powder. (data for Fig. 4.40–4.42)

Addives	Content (wt%)	Flexural strength (N/mm ²)		Water absorption (%)		Bulk density (g/cm ³)	
		FG	NG	FG	NG	FG	NG
Citric acid	0.00	6.17±1.76	6.01±1.03	52.43±1.75	54.87±1.47	0.97±0.07	0.94±0.12
	0.02	5.77±1.23	5.69±1.26	54.16±1.86	57.63±2.02	0.94±0.04	0.92±0.09
	0.04	5.13±1.65	5.01±1.97	57.72±2.03	60.54±1.93	0.92±0.02	0.89±0.09
	0.06	4.61±2.01	4.46±0.83	59.89±1.94	63.10±1.38	0.89±0.10	0.86±0.01
	0.08	4.18±0.95	4.03±1.45	63.86±1.56	67.79±1.65	0.87±0.05	0.82±0.04
	0.10	3.02±1.17	2.91±1.32	67.21±2.27	69.81±2.11	0.83±0.08	0.80±0.05
Methyl cellulose	0.00	6.15±1.85	6.06±1.53	51.26±1.24	53.09±1.36	0.96±0.02	0.93±0.03
	0.02	5.89±1.48	5.74±1.27	53.85±1.35	56.57±1.21	0.94±0.04	0.91±0.08
	0.04	5.47±1.53	5.32±1.49	55.30±1.66	58.33±1.87	0.93±0.05	0.88±0.01
	0.06	4.81±1.92	4.65±1.81	57.74±1.53	61.84±1.40	0.91±0.07	0.86±0.04
	0.08	4.36±1.36	4.20±1.76	60.69±1.70	63.65±1.69	0.88±0.05	0.84±0.03
	0.10	3.73±1.79	3.39±1.30	63.75±2.10	65.80±1.98	0.85±0.06	0.82±0.07
Acetic acid	0.00	6.20±0.91	6.11±1.03	51.78±1.51	53.14±1.86	0.93±0.02	0.90±0.06
	0.20	6.03±1.76	5.85±1.38	53.27±1.38	54.73±1.49	0.92±0.05	0.88±0.04
	0.40	5.87±1.41	5.46±1.57	54.06±2.04	56.65±1.63	0.90±0.03	0.87±0.09
	0.60	5.54±1.13	5.28±1.26	55.71±1.67	57.58±1.94	0.89±0.07	0.86±0.02
	0.80	5.15±1.65	5.03±1.14	57.83±1.21	59.69±1.25	0.88±0.10	0.84±0.03
	1.00	4.91±2.11	4.75±1.83	58.99±1.86	61.17±2.02	0.86±0.08	0.83±0.05
Potassium alum	0.00	6.12±1.13	6.03±2.11	50.88±1.14	52.26±1.75	0.95±0.01	0.92±0.06
	0.20	5.98±1.36	5.75±1.13	52.61±1.69	54.37±1.36	0.92±0.09	0.90±0.04
	0.40	5.67±1.67	5.34±1.53	54.92±1.85	55.98±1.28	0.90±0.03	0.88±0.07
	0.60	5.26±1.24	5.11±1.65	55.54±1.33	57.58±2.01	0.89±0.05	0.87±0.11
	0.80	4.89±0.83	4.73±1.89	56.13±1.65	58.07±1.48	0.87±0.02	0.86±0.05
	1.00	4.53±1.76	4.27±1.47	58.80±2.15	61.63±1.98	0.85±0.08	0.84±0.03
Sodium borate	0.00	6.19±0.90	6.13±1.65	52.45±1.89	54.01±1.37	0.94±0.07	0.91±0.04
	0.20	6.09±1.70	5.98±1.58	53.76±1.39	56.74±2.01	0.93±0.05	0.89±0.03
	0.40	5.76±2.05	5.61±1.05	54.38±1.13	58.58±1.54	0.91±0.03	0.87±0.07
	0.60	5.43±1.46	5.32±1.87	57.49±1.42	60.29±1.85	0.89±0.02	0.86±0.09
	0.80	5.16±1.57	5.07±1.14	60.68±1.68	61.61±1.73	0.88±0.09	0.84±0.01
	1.00	4.80±1.93	4.63±1.93	61.15±2.31	63.38±2.18	0.86±0.06	0.83±0.05

* the number of each sample specimens was 5.

Table 11 Effect of additives on the physical properties of gypsum board specimens prepared from MP. (data for Fig. 4.43–4.45)

Additives	Content (wt%)	Flexural strength (N/mm ²)			Water absorption (%)			Bulk density (g/cm ³)		
		B	P	NG	B	P	NG	B	P	NG
Calcium sulfate dihydrate	0.0	6.60±0.52	6.49±0.65	6.36±0.48	44.39±1.24	46.57±1.30	48.61±1.12	1.38±0.02	1.36±0.01	1.35±0.03
	0.5	6.79±0.97	6.68±1.02	6.55±1.10	42.50±1.75	44.61±1.46	46.24±1.07	1.40±0.03	1.38±0.04	1.36±0.10
	1.0	6.90±1.19	6.87±1.05	6.73±0.93	41.28±1.60	43.85±1.38	45.85±1.51	1.42±0.05	1.40±0.04	1.38±0.06
	1.5	7.13±1.04	7.05±1.21	6.84±1.15	40.66±1.31	41.27±1.20	43.04±1.42	1.43±0.06	1.42±0.06	1.39±0.03
	2.0	6.74±1.65	6.78±1.54	6.96±1.20	43.75±2.24	44.90±2.10	42.79±1.64	1.39±0.10	1.37±0.07	1.41±0.04
Potassium sulfate	0.0	6.61±0.47	6.50±0.52	6.37±0.39	44.59±1.21	46.81±1.02	48.36±1.36	1.39±0.02	1.36±0.04	1.36±0.05
	0.5	6.46±1.12	6.34±1.20	6.21±1.01	47.63±1.38	48.03±1.54	49.76±1.14	1.37±0.01	1.34±0.01	1.33±0.04
	1.0	6.30±1.25	6.11±1.12	6.04±0.98	50.17±1.76	50.58±1.47	51.39±1.33	1.35±0.10	1.33±0.09	1.31±0.06
	1.5	6.17±1.13	5.97±1.05	5.96±1.26	51.40±1.59	52.72±1.35	53.67±1.93	1.32±0.05	1.30±0.05	1.29±0.03
	2.0	6.05±1.43	5.88±1.56	5.82±1.14	53.39±1.97	53.80±1.84	54.05±1.85	1.30±0.04	1.28±0.04	1.27±0.02
Sulfuric acid	0.0	6.58±0.32	6.51±0.61	6.38±0.40	43.26±1.70	45.20±1.58	47.52±1.27	1.37±0.01	1.35±0.03	1.33±0.02
	0.5	6.42±0.97	6.36±1.13	6.23±1.03	45.42±1.24	47.83±1.37	49.54±1.40	1.36±0.06	1.35±0.07	1.31±0.03
	1.0	6.29±1.13	6.13±1.26	6.08±1.17	48.76±1.55	50.14±1.68	51.39±1.26	1.34±0.04	1.30±0.06	1.29±0.04
	1.5	6.14±1.20	5.99±1.03	5.94±1.14	51.02±1.40	52.75±1.13	53.06±1.65	1.32±0.02	1.29±0.05	1.26±0.03
	2.0	6.02±1.16	5.84±1.32	5.79±1.25	53.14±1.99	54.06±2.18	54.88±1.73	1.30±0.07	1.27±0.06	1.25±0.05

* the number of each sample specimens was 5.

Table 12 Effect of grinding time on the particle size of MP prepared from bulk materials (density of B = 2.60 ± 0.03 g/cm³, P = 2.64 ± 0.04 g/cm³ and NG = 2.79 ± 0.04 g/cm³) and from mixing 45 wt% β -HH, 5 wt% AIII and 50 wt% AII powders (density of mixed phase powder prepared from FG = 2.57 ± 0.03 g/cm³ and NG = 2.73 ± 0.05 g/cm³). (data for Fig. 4.45)

Grinding time (min.)	Specific surface area (1×10^{-4} m ² /g)					Mean particle size from calculation (μ m)				
	B	P	NG	FG (mixed)	NG (mixed)	B	P	NG	FG (mixed)	NG (mixed)
0	19.59±0.30	19.40±0.21	18.15±0.37	23.67±0.36	21.76±0.25	1177.99±16.36	1171.15±15.27	1184.86±16.71	986.45±13.11	1010.01±13.09
1	24.97±0.41	25.48±0.50	21.99±0.24	36.44±0.40	32.07±0.47	924.49±12.85	892.67±13.58	978.43±13.80	637.12±9.78	685.28±11.52
2	32.23±0.34	30.79±0.37	28.45±0.41	96.52±1.35	64.35±0.59	716.20±12.72	738.10±12.97	756.12±14.21	241.89±5.01	341.52±8.43
4	41.36±0.85	39.18±0.76	35.96±0.55	214.92±5.98	114.08±1.21	558.35±10.44	580.45±13.93	598.37±14.93	108.63±3.42	192.65±9.48
6	67.48±1.22	61.26±1.48	45.18±0.71	555.60±10.27	287.41±2.54	342.02±5.36	371.16±8.67	476.54±10.65	42.02±0.85	76.47±1.67
8	116.55±3.11	123.51±2.13	71.44±1.73	1253.15±13.40	624.02±10.66	198.68±7.02	184.53±4.28	301.10±7.38	18.63±0.23	35.22±0.59
10	311.85±7.63	280.58±9.28	147.29±3.65	1921.51±22.84	1135.82±21.35	74.26±1.35	81.39±1.63	146.28±4.21	12.15±0.35	19.35±0.21
12	769.23±11.84	688.70±12.76	364.49±9.81	2192.14±28.63	1734.65±25.76	30.87±0.58	33.64±0.71	59.46±1.63	10.65±0.18	12.67±0.14
14	1442.31±18.65	1623.37±21.75	655.65±14.54	1307.92±19.85	890.88±15.30	16.05±0.17	14.31±0.24	32.80±0.64	17.85±0.26	24.67±0.38
16	2307.69±29.88	2525.29±21.75	1164.34±23.60	799.53±15.21	551.52±13.81	10.49±0.20	9.87±0.19	17.47±0.21	29.20±0.32	39.85±0.26
18	1775.15±30.02	1893.94±28.46	1955.03±32.13	715.05±14.38	1090.18±20.32	13.73±0.24	12.51±0.23	11.56±0.15	32.65±0.24	20.16±0.15
20	1214.57±21.38	1262.28±31.75	1536.10±27.83	1201.56±25.43	823.15±17.08	19.60±0.32	18.63±0.30	14.37±0.19	19.43±0.16	26.70±0.22

* the number of test sample was 5.

Table 13 Particle size distribution of MP by centrifugal particle size analyzer. (data for Fig. 4.47)

Diameter (μm)	% Finer than				
	B	P	NG	FG (mixed)	NG (mixed)
40.0	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00
30.0	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00
20.0	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00	100.00 \pm 0.00
10.0	50.92 \pm 0.27	53.60 \pm 0.31	48.82 \pm 0.17	51.24 \pm 0.35	50.01 \pm 0.26
8.0	42.70 \pm 0.16	46.48 \pm 0.26	41.56 \pm 0.18	44.38 \pm 0.24	41.94 \pm 0.33
6.0	29.84 \pm 0.38	33.12 \pm 0.35	30.20 \pm 0.30	31.63 \pm 0.16	31.15 \pm 0.15
5.0	24.72 \pm 0.20	27.84 \pm 0.19	22.64 \pm 0.24	25.47 \pm 0.20	23.69 \pm 0.28
4.0	18.42 \pm 0.14	20.30 \pm 0.11	15.18 \pm 0.26	17.88 \pm 0.19	16.31 \pm 0.22
3.0	17.78 \pm 0.21	18.60 \pm 0.23	13.48 \pm 0.17	16.35 \pm 0.22	13.02 \pm 0.20
2.0	11.76 \pm 0.25	12.26 \pm 0.20	8.66 \pm 0.13	12.50 \pm 0.29	9.63 \pm 0.18
1.0	4.40 \pm 0.30	6.56 \pm 0.27	3.50 \pm 0.21	5.79 \pm 0.31	6.11 \pm 0.19

* the number of test sample was 3.

Table 14 Effect of the content of methylcellulose on physical properties of MP prepared from bulk materials and mixed phase composition. (data for Fig. 4.49)

Methylcellulose (wt%)	Flexural strength (N/mm ²)				
	B	P	NG	FG (mixed)	NG (mixed)
0.00	5.60 \pm 0.35	4.41 \pm 0.42	3.50 \pm 0.36	5.20 \pm 0.50	3.48 \pm 0.49
0.02	5.12 \pm 0.28	4.18 \pm 0.30	3.21 \pm 0.22	5.03 \pm 0.42	3.12 \pm 0.36
0.04	4.73 \pm 0.25	3.65 \pm 0.25	2.79 \pm 0.31	4.82 \pm 0.35	2.70 \pm 0.41
0.06	4.26 \pm 0.29	3.28 \pm 0.27	2.35 \pm 0.19	4.37 \pm 0.32	2.42 \pm 0.39
0.08	3.89 \pm 0.33	3.05 \pm 0.18	2.01 \pm 0.20	3.81 \pm 0.37	2.18 \pm 0.36
0.10	3.40 \pm 0.21	2.74 \pm 0.20	1.76 \pm 0.25	3.35 \pm 0.43	1.85 \pm 0.32
	Water absorption (%)				
0.00	31.32 \pm 1.53	33.25 \pm 1.76	33.99 \pm 1.55	32.43 \pm 1.67	33.90 \pm 1.58
0.02	34.47 \pm 1.42	36.85 \pm 1.40	37.42 \pm 1.38	34.16 \pm 1.58	37.21 \pm 1.51
0.04	38.27 \pm 1.36	39.21 \pm 2.03	41.33 \pm 1.29	38.03 \pm 1.35	41.28 \pm 2.38
0.06	42.03 \pm 1.27	43.40 \pm 1.86	45.26 \pm 1.63	41.86 \pm 1.40	45.45 \pm 1.42
0.08	45.18 \pm 2.01	47.55 \pm 1.21	49.50 \pm 1.47	45.02 \pm 1.72	49.12 \pm 1.67
0.10	49.84 \pm 1.45	52.36 \pm 1.36	54.39 \pm 1.80	49.71 \pm 1.33	54.20 \pm 1.70
	Bulk density (g/cm ³)				
0.00	2.09 \pm 0.05	2.05 \pm 0.04	1.99 \pm 0.08	2.08 \pm 0.06	1.99 \pm 0.07
0.02	2.07 \pm 0.04	2.03 \pm 0.06	1.97 \pm 0.04	2.07 \pm 0.03	1.96 \pm 0.02
0.04	2.03 \pm 0.02	2.01 \pm 0.02	1.96 \pm 0.03	2.04 \pm 0.04	1.95 \pm 0.03
0.06	2.01 \pm 0.01	1.98 \pm 0.03	1.93 \pm 0.05	2.01 \pm 0.03	1.94 \pm 0.01
0.08	1.99 \pm 0.02	1.96 \pm 0.03	1.91 \pm 0.02	1.99 \pm 0.03	1.92 \pm 0.03
0.10	1.96 \pm 0.04	1.93 \pm 0.07	1.90 \pm 0.06	1.97 \pm 0.05	1.91 \pm 0.04

* number of each sample specimens was 5.

Table 15 Effect of the content of additives on the viscosity and setting time of projection plaster (humidity = 72%, room and water temperatures = 33 °C and 30 °C, pH of water = 7.74 and W/P = 0.6). (data for Fig. 4.50 and 4.52)

Additives (wt%)	$\eta \times 100$ (cps)																	
	Setting time (min.)						Initial						Final					
	S	M	B	P	NG	B	P	NG	B	P	NG	B	P	NG				
0	0	45.30±1.69	58.00±1.75	37.30±1.48	41.25±0.36	52.04±0.28	58.53±0.40	135.30±2.45	141.37±3.11	132.19±2.86								
0	0.125	48.50±1.50	61.70±1.82	41.00±1.89	52.36±0.17	61.35±0.45	67.21±0.27	148.26±1.96	155.23±2.50	143.27±2.80								
0	0.250	51.17±1.78	65.00±2.26	44.50±1.80	61.21±0.29	70.27±0.36	75.07±0.35	162.15±2.75	167.28±1.87	156.14±3.20								
0	0.375	55.00±2.49	68.30±1.35	48.50±1.61	70.43±0.30	79.02±0.12	85.35±0.29	175.48±3.26	183.14±2.41	168.50±1.98								
0	0.500	58.70±2.36	70.30±1.78	51.17±1.57	80.38±0.11	88.49±0.39	93.21±0.20	190.30±1.98	197.45±2.70	183.37±2.76								
0.250	0	26.00±1.95	36.30±1.90	24.30±1.50	34.59±0.42	44.55±0.26	49.08±0.37	130.21±2.83	138.30±1.89	125.33±1.83								
0.500	0	15.30±1.87	17.70±2.14	13.50±2.10	28.21±0.50	38.34±0.39	44.28±0.26	124.26±1.69	133.11±3.60	121.42±2.59								
0.750	0	6.17±1.63	7.50±1.37	5.70±1.76	24.07±0.33	33.27±0.20	38.17±0.18	120.11±1.80	129.50±3.20	116.30±3.01								
1.000	0	4.30±1.79	6.00±1.93	3.17±2.14	20.38±0.21	28.11±0.37	33.43±0.24	115.36±2.14	123.46±1.75	110.25±4.32								
0.250	0.125	27.00±2.02	38.17±1.55	26.50±1.32	51.21±0.29	61.30±0.44	65.07±0.39	146.58±3.32	154.37±1.55	142.46±2.78								
0.250	0.250	30.30±1.49	39.50±2.24	28.50±1.55	59.37±0.35	69.26±0.26	74.19±0.40	161.25±4.69	165.21±1.80	154.28±2.01								
0.250	0.375	32.00±2.23	41.70±1.31	29.70±1.94	68.15±0.42	77.24±0.17	83.28±0.57	174.23±2.46	180.39±2.21	165.39±3.76								
0.250	0.500	33.70±1.99	43.50±2.09	32.00±1.26	78.42±0.51	85.31±0.20	90.31±0.33	188.37±3.02	195.47±1.43	181.10±1.58								
0.500	0.125	18.17±1.27	19.30±2.11	16.50±1.98	48.30±0.19	59.45±0.38	62.45±0.28	144.40±1.85	152.31±4.28	140.32±3.18								
0.500	0.250	21.00±2.30	20.00±1.77	18.30±2.32	56.27±0.24	67.12±0.40	73.36±0.40	158.06±3.42	163.50±2.75	152.09±1.93								
0.500	0.375	22.50±1.76	23.17±1.81	20.50±1.35	65.49±0.30	77.51±0.26	81.28±0.31	171.12±2.71	178.10±3.02	167.51±2.50								
0.500	0.500	24.30±2.18	25.50±1.40	22.70±1.74	76.52±0.43	84.47±0.19	89.22±0.25	186.35±2.38	192.44±2.44	179.28±4.58								
0.750	0.125	7.70±2.01	8.30±1.25	7.17±2.17	44.11±0.36	56.23±0.27	60.35±0.16	142.29±2.11	150.09±1.63	138.39±1.93								
0.750	0.250	9.30±1.36	11.00±1.81	8.50±1.85	55.28±0.31	66.10±0.45	70.20±0.37	156.14±2.69	162.28±2.85	151.23±2.04								
0.750	0.375	12.00±1.85	13.00±2.33	10.30±1.53	62.45±0.27	75.32±0.26	80.17±0.20	169.40±3.70	175.36±3.11	164.17±2.51								
0.750	0.500	14.50±1.93	16.17±1.47	13.70±1.61	72.30±0.19	81.64±0.31	86.42±0.29	183.07±1.90	190.57±1.93	176.30±3.10								
1.000	0.125	5.00±2.21	6.70±1.96	4.70±1.80	40.26±0.28	51.38±0.42	57.39±0.35	140.39±3.11	147.33±1.76	135.44±1.72								
1.000	0.250	7.70±1.95	8.50±2.02	6.70±1.78	53.07±0.35	63.49±0.54	67.32±0.42	153.24±1.47	160.48±1.89	147.20±1.90								
1.000	0.375	9.17±1.51	11.30±1.65	8.00±2.20	59.35±0.46	71.07±0.33	78.46±0.37	165.22±2.26	171.58±3.03	160.11±2.81								
1.000	0.500	12.50±1.32	13.00±2.15	11.00±1.54	67.19±0.29	76.15±0.18	82.51±0.36	179.38±1.78	188.40±2.69	172.48±3.21								

* the number of test sample was 3, S = Sodium lignosulfonate, M = Methylcellulose.

Table 16 Effect of the content of additives on surface coverage and surface hardness of projection plaster (humidity = 72%, room and water temperatures = 33 °C and 30 °C, pH of water = 7.74 and W/P=0.60). (data for Fig. 4.43)

Additives (wt%)		Surface coverage (m ² /100 kg)				Surface hardness				
		B	P	NG		Gouge		Scratch		
S	M	B	P	NG	B	P	NG	B	P	NG
0	0	13.87±0.87	14.06±0.60	13.65±0.51	H	H	F	4B	4B	4B
0	0.125	13.23±0.93	14.47±0.75	13.21±0.27	H	H	F	4B	4B	4B
0	0.250	13.65±0.21	14.83±0.64	13.19±0.96	H	F	F	3B	3B	4B
0	0.375	13.48±0.54	14.60±0.86	13.45±0.85	F	F	HB	4B	4B	3B
0	0.500	14.15±0.38	15.17±0.75	13.38±0.27	HB	HB	HB	5B	5B	4B
0.250	0	11.20±0.25	12.58±0.44	11.89±0.55	H	H	F	3B	3B	4B
0.500	0	11.17±0.63	11.64±0.58	10.12±0.58	H	H	H	3B	3B	3B
0.750	0	9.64±0.75	10.13±0.60	9.63±0.21	2H	2H	2H	2B	2B	2B
1.000	0	8.45±1.02	8.96±0.91	8.17±0.76	H	H	H	3B	3B	3B
0.250	0.125	11.32±0.76	12.64±0.70	11.23±0.85	F	F	F	3B	3B	3B
0.250	0.250	12.51±0.58	12.50±0.86	12.46±0.20	F	F	F	3B	3B	3B
0.250	0.375	12.20±1.03	12.45±0.54	12.35±0.95	H	F	F	2B	2B	3B
0.250	0.500	12.47±0.66	12.82±0.84	12.11±0.83	F	H	H	4B	2B	2B
0.500	0.125	11.38±0.47	11.40±0.27	10.33±0.81	H	H	H	3B	3B	3B
0.500	0.250	11.51±0.95	11.21±0.11	11.02±0.47	2H	H	2H	2B	3B	2B
0.500	0.375	11.07±0.34	11.10±0.93	11.38±0.80	H	2H	H	3B	2B	3B
0.500	0.500	11.18±0.52	11.37±0.24	11.70±0.26	H	H	F	3B	3B	4B
0.750	0.125	10.17±0.84	10.23±1.06	10.41±0.42	2H	2H	2H	2B	2B	2B
0.750	0.250	10.47±0.59	10.69±0.39	10.32±0.57	H	H	H	3B	3B	3B
0.750	0.375	10.28±0.78	10.38±0.76	10.88±0.26	H	H	H	2B	3B	2B
0.750	0.500	10.55±0.93	10.70±1.08	10.36±0.99	F	F	F	3B	4B	3B
1.000	0.125	9.10±0.51	10.41±0.95	8.96±0.56	H	F	F	3B	4B	4B
1.000	0.250	10.24±0.74	10.75±0.33	10.11±0.90	2H	H	H	2B	3B	3B
1.000	0.375	10.55±0.80	10.93±0.76	10.87±0.38	H	H	H	3B	3B	3B
1.000	0.500	10.38±0.21	10.26±0.49	10.63±0.56	F	F	H	4B	4B	3B

* the number of test sample was 3, S = Sodium lignosulfonate, M = Methylcellulose.

Table 17 Effect of the content of additives on physical properties of projection plaster (humidity = 68%, room and water temperatures = 34°C and 31°C, pH of water = 7.56 and W/P = 0.60). (data for Fig. 4.54-4.56)

Additive (wt%)		Flexural strength (N/mm ²)			Water absorption (%)			Bulk density (g/cm ³)		
S	M	B	P	NG	B	P	NG	B	P	NG
0	0	5.60±0.29	4.41±0.35	3.52±0.14	31.76±1.79	32.53±2.05	33.86±1.90	2.10±0.05	2.04±0.08	2.01±0.08
0	0.125	4.97±0.38	4.08±0.14	3.20±0.20	33.45±1.38	36.76±1.80	36.28±1.68	2.07±0.02	2.02±0.11	1.99±0.01
0	0.250	4.46±0.47	3.62±0.20	2.85±0.29	39.38±1.65	40.83±1.33	42.59±1.34	2.05±0.01	2.00±0.08	1.98±0.04
0	0.375	3.81±0.18	3.14±0.32	2.39±0.37	44.50±2.02	45.92±1.76	48.40±1.31	2.02±0.03	1.98±0.06	1.96±0.04
0	0.500	3.37±0.50	2.78±0.36	2.02±0.31	49.89±1.43	51.74±1.38	54.55±1.27	2.00±0.07	1.96±0.07	1.94±0.03
0.25	0	5.85±0.41	4.69±0.42	3.90±0.38	30.19±1.62	30.85±1.65	31.42±1.80	2.11±0.06	2.07±0.02	2.04±0.05
0.50	0	5.99±0.26	4.85±0.35	4.14±0.36	28.57±1.40	28.24±1.70	29.60±1.55	2.13±0.10	2.09±0.05	2.06±0.07
0.75	0	6.16±0.39	5.03±0.28	4.32±0.42	25.63±1.78	26.39±1.26	26.98±1.26	2.14±0.05	2.10±0.03	2.08±0.08
1.00	0	6.23±0.30	5.20±0.25	4.56±0.18	22.42±1.65	24.56±2.10	25.77±1.31	2.16±0.05	2.12±0.04	2.10±0.04
0.25	0.125	5.42±0.28	4.40±0.18	3.63±0.25	31.85±2.10	33.89±1.49	33.33±1.74	2.09±0.04	2.05±0.04	2.02±0.06
0.25	0.250	5.20±0.39	4.19±0.16	3.40±0.35	33.40±1.49	36.51±1.30	36.85±1.68	2.07±0.02	2.04±0.05	2.00±0.03
0.25	0.375	4.86±0.33	3.95±0.27	3.18±0.42	35.27±1.38	38.73±1.26	39.60±2.04	2.05±0.03	2.02±0.09	1.99±0.02
0.25	0.500	4.60±0.15	3.76±0.38	2.99±0.18	38.19±1.07	41.62±1.17	42.91±1.53	2.04±0.06	2.00±0.07	1.98±0.05
0.50	0.125	5.51±0.20	4.50±0.20	3.71±0.29	31.04±1.25	32.44±1.44	32.74±2.09	2.10±0.08	2.06±0.04	2.03±0.07
0.50	0.250	5.28±0.27	4.26±0.25	3.55±0.36	34.45±1.86	35.38±1.87	34.38±1.77	2.08±0.07	2.05±0.06	2.02±0.08
0.50	0.375	4.92±0.31	4.01±0.30	3.27±0.45	36.62±1.42	38.56±1.65	38.21±1.45	2.07±0.07	2.04±0.02	2.00±0.07
0.50	0.500	4.74±0.48	3.87±0.35	3.09±0.22	39.48±2.00	40.39±1.38	41.15±1.38	2.06±0.05	2.02±0.03	1.99±0.06
0.75	0.125	5.65±0.36	4.61±0.20	3.80±0.19	28.73±1.17	30.78±2.01	31.07±1.40	2.11±0.03	2.06±0.05	2.04±0.06
0.75	0.250	5.37±0.45	4.37±0.49	3.64±0.38	31.56±1.95	33.21±1.40	34.49±1.53	2.10±0.03	2.04±0.09	2.03±0.06
0.75	0.375	5.04±0.38	4.12±0.37	3.38±0.46	32.49±1.24	35.19±1.21	37.62±2.10	2.08±0.02	2.02±0.08	2.01±0.05
0.75	0.500	4.80±0.14	3.91±0.31	3.17±0.35	34.28±1.73	38.02±1.39	40.88±1.69	2.07±0.10	2.01±0.07	1.99±0.03
1.00	0.125	5.71±0.19	4.72±0.28	3.88±0.21	28.76±1.18	30.88±1.57	30.41±1.57	2.12±0.04	2.08±0.4	2.06±0.04
1.00	0.250	5.48±0.25	4.49±0.29	3.73±0.30	31.85±1.49	32.46±1.92	33.56±1.32	2.11±0.01	2.06±0.05	2.05±0.02
1.00	0.375	5.12±0.28	4.23±0.13	3.45±0.32	34.40±2.04	35.76±1.56	36.78±1.55	2.09±0.03	2.04±0.06	2.02±0.01
1.00	0.500	4.93±0.34	4.08±0.45	3.26±0.19	36.55±1.55	38.89±2.08	39.51±1.39	2.08±0.02	2.03±0.11	2.01±0.05

*The number of each sample specimens was 5. S= Sodium lignosulfonate, M = Methylcellulose, V = Vinyl acetate.

Table 18 Effect of the content of vinyl acetate on viscosity and setting time of the modified projection plaster (humidity = 69%, room and water temperatures = 34°C and 30°C, pH of water = 7.63 and W/P=0.60). (data for Fig. 4.57-4.58)

Additives (wt%)		$\eta \times 100$ (cps)					Setting time (min.)				
S	M	V	B	P	NG	B	P	NG	B	P	NG
0	0	0	47.70±1.98	56.30±2.17	39.50±1.80	43.40±0.45	50.58±0.36	59.17±0.51	131.49±3.45	144.26±3.87	129.53±2.93
0	0	0.250	40.17±1.75	49.50±1.38	32.30±1.76	46.15±0.29	54.21±0.40	62.36±0.47	138.20±1.96	151.36±3.56	136.09±2.39
0	0	0.50	37.50±1.50	45.17±2.13	29.30±1.31	48.38±0.38	57.04±0.21	64.48±0.30	143.46±2.75	156.42±3.09	141.15±4.05
0	0	0.750	35.00±2.02	42.50±1.93	27.70±1.80	51.24±0.26	59.46±0.37	67.20±0.21	150.35±2.38	161.30±2.14	158.24±2.85
0	0	1.000	32.30±1.38	40.00±1.45	25.17±1.43	54.46±0.18	63.32±0.29	69.14±0.26	157.11±3.27	168.21±2.45	165.03±2.70
0.750	0	0	6.50±1.75	7.70±1.82	5.30±1.95	26.35±0.35	34.57±0.52	37.14±0.19	118.29±2.16	132.40±2.17	114.32±2.36
0.750	0	0.250	5.17±1.57	6.17±1.67	5.00±1.56	29.55±0.45	38.15±0.48	42.59±0.34	122.42±2.63	136.54±3.96	116.15±3.05
0.750	0	0.500	4.50±1.64	5.30±1.58	4.30±2.10	32.40±0.27	42.27±0.36	44.20±0.53	125.10±2.74	138.11±4.11	119.20±2.71
0.750	0	0.750	4.00±2.01	4.50±1.42	3.70±1.71	36.17±0.36	45.28±0.21	48.31±0.28	127.21±1.87	142.45±2.87	121.52±3.29
0.750	0	1.000	3.30±1.93	4.00±2.04	3.00±1.58	39.30±0.50	48.35±0.30	52.17±0.39	131.26±2.93	145.30±2.69	125.38±2.35
0.750	0.125	0	7.30±1.30	8.50±1.85	6.70±1.93	48.17±0.28	57.25±0.24	61.49±0.45	138.39±2.14	155.47±3.01	140.14±2.14
0.750	0.125	0.250	7.00±1.47	8.17±1.79	6.30±1.43	50.26±0.35	60.01±0.45	63.38±0.21	142.24±4.01	158.38±2.29	144.27±2.66
0.750	0.125	0.500	6.50±1.33	7.30±2.11	6.00±1.26	52.35±0.41	62.26±0.37	66.25±0.46	145.31±1.85	160.21±3.85	146.02±2.83
0.750	0.125	0.750	6.17±1.60	6.70±1.48	5.30±2.15	55.41±0.22	64.17±0.33	69.10±0.25	149.02±2.30	164.33±3.56	149.38±1.95
0.750	0.125	1.000	5.30±1.55	6.17±1.52	5.17±1.79	58.32±0.36	67.11±0.25	71.76±0.39	154.37±3.16	167.49±2.70	151.45±3.52
1.000	0.250	0	7.17±1.78	8.30±1.45	6.70±1.32	50.58±0.45	61.32±0.40	69.21±0.26	157.43±2.34	164.22±1.93	142.26±1.98
1.000	0.250	0.250	6.50±2.11	8.00±1.36	6.30±1.63	53.29±0.21	64.48±0.37	71.38±0.41	160.11±2.48	166.17±3.86	146.32±2.63
1.000	0.250	0.500	6.17±1.75	7.50±1.56	6.00±1.54	54.32±0.45	66.50±0.42	73.44±0.33	163.20±2.69	170.35±1.75	149.37±2.75
1.000	0.250	0.750	5.70±1.39	7.17±1.80	5.70±1.36	56.42±0.53	68.24±0.20	76.36±0.37	167.35±3.84	173.32±2.83	152.21±4.14
1.000	0.250	1.000	5.30±1.50	7.30±2.02	4.70±1.90	59.02±0.26	71.03±0.35	79.22±0.28	170.51±2.22	178.49±2.45	156.50±2.98

* the number of test sample was 3, S = Sodium lignosulfonate, M = Methylcellulose, V = Vinyl acetate.

Table 19 Effect of the content of vinyl acetate on surface coverage and surface hardness of the modified projection plaster (humidity = 69%, room and water temperatures = 34°C and 30°C, pH of water = 7.63 and W/P=0.60). (data for Fig. 4.59)

Additives (wt%)				Surface coverage (m ² /100 kg)				Surface hardness							
S	M	V		B	P	NG	Gouge				Scratch				
							B	P	NG	F	B	P	NG		
0	0	0		13.96±0.98	13.98±1.14	13.75±0.75	H	H	F		4B	4B	4B		
0	0	0.250		13.75±0.75	13.36±0.32	13.27±0.61	H	H	H		3B	3B	4B		
0	0	0.50		13.34±0.36	13.45±0.58	12.90±0.28	H	H	H		2B	2B	4B		
0	0	0.750		13.20±0.42	13.60±1.10	12.85±0.90	2H	2H	2H		B	B	3B		
0	0	1.000		12.76±0.57	13.27±0.70	12.52±0.35	3H	H	2H		3B	3B	4B		
0.750	0	0		9.75±0.21	10.28±0.38	9.21±0.61	2H	2H	2H		2B	2B	4B		
0.750	0	0.250		9.18±0.83	10.35±0.51	9.02±0.32	3H	3H	2H		HB	HB	3B		
0.750	0	0.500		8.82±0.65	10.60±0.42	8.75±1.07	2H	2H	H		B	B	2B		
0.750	0	0.750		8.63±1.07	9.42±0.36	8.36±0.58	H	H	H		B	2B	3B		
0.750	0	1.000		7.90±0.26	8.86±0.81	7.97±0.49	H	H	F		2B	3B	3B		
0.750	0.125	0		10.76±0.55	10.38±0.43	10.52±0.82	2H	2H	2H		2B	2B	3B		
0.750	0.125	0.250		10.42±0.49	10.16±0.72	10.38±0.35	2H	2H	2H		B	B	3B		
0.750	0.125	0.500		10.11±0.75	10.20±1.01	10.55±0.71	3H	3H	3H		HB	HB	2B		
0.750	0.125	0.750		10.29±0.61	10.84±0.45	10.48±0.58	2H	2H	2H		2B	2B	3B		
0.750	0.125	1.000		9.57±0.40	10.23±0.92	9.19±0.29	2H	H	2H		2B	3B	2B		
1.000	0.250	0		10.38±0.67	10.54±0.78	10.29±0.52	2H	H	H		2B	3B	3B		
1.000	0.250	0.250		10.45±0.35	10.81±0.30	10.58±1.05	2H	H	H		B	2B	2B		
1.000	0.250	0.500		10.08±0.68	10.75±0.41	9.63±0.39	3H	2H	2H		HB	B	B		
1.000	0.250	0.750		9.45±0.22	10.41±0.63	9.17±0.75	2H	2H	2H		B	B	2B		
1.000	0.250	1.000		9.21±0.37	10.30±0.55	9.10±0.34	2H	H	H		2B	2B	2B		

* the number of test sample was 3, S = Sodium lignosulfonate, M = Methylcellulose.

Table 20 Effect of the content of vinyl acetate on physical properties of MP the modified projection plaster (humidity = 76%, room and water temperatures = 33°C and 30°C, pH of water = 7.27 and W/P = 0.60). (data for Fig. 4.60–4.62)

Additive (wt%)			Flexural strength (N/mm ²)				Water absorption (%)				Bulk density (g/cm ³)			
S	M	V	B	P	NG	B	P	NG	B	P	NG	B	P	NG
0	0	0	5.58±0.42	4.40±0.51	3.49±0.46	31.88±1.85	33.37±2.07	34.02±1.85	2.09±0.05	2.05±0.08	2.03±0.04	2.09±0.05	2.05±0.08	2.03±0.04
0	0	0.25	5.84±0.39	4.81±0.27	3.90±0.40	29.26±1.64	31.40±1.79	32.56±1.76	2.11±0.02	2.08±0.06	2.06±0.07	2.11±0.02	2.08±0.06	2.06±0.07
0	0	0.50	6.11±0.28	5.18±0.30	4.31±0.25	27.84±1.32	29.33±1.46	30.42±1.40	2.13±0.04	2.11±0.05	2.10±0.01	2.13±0.04	2.11±0.05	2.10±0.01
0	0	0.75	5.80±0.20	4.93±0.18	3.94±0.37	29.79±1.49	31.88±1.58	31.78±1.24	2.11±0.06	2.09±0.09	2.08±0.03	2.11±0.06	2.09±0.09	2.08±0.03
0	0	1.00	5.65±0.19	4.70±0.26	3.62±0.26	30.25±2.01	32.21±1.79	33.20±1.56	2.10±0.03	2.07±0.10	2.05±0.02	2.10±0.03	2.07±0.10	2.05±0.02
0.75	0	0	6.11±0.37	5.03±0.45	4.27±0.35	28.02±1.93	29.48±1.84	29.06±1.91	2.10±0.07	2.08±0.03	2.07±0.08	2.10±0.07	2.08±0.03	2.07±0.08
0.75	0	0.25	6.13±0.21	5.07±0.32	4.32±0.20	27.45±1.48	28.76±1.50	28.26±1.32	2.11±0.07	2.09±0.01	2.08±0.05	2.11±0.07	2.09±0.01	2.08±0.05
0.75	0	0.50	6.16±0.25	5.12±0.28	4.35±0.29	26.21±1.30	27.05±1.25	27.14±1.47	2.12±0.04	2.10±0.04	2.09±0.04	2.12±0.04	2.10±0.04	2.09±0.04
0.75	0	0.75	5.99±0.34	4.98±0.25	4.10±0.28	28.39±1.59	28.60±1.66	28.53±1.30	2.11±0.02	2.08±0.02	2.07±0.07	2.11±0.02	2.08±0.02	2.07±0.07
0.75	0	1.00	5.84±0.40	4.82±0.31	4.00±0.32	29.61±1.65	30.31±1.42	30.46±1.31	2.09±0.05	2.07±0.08	2.06±0.06	2.09±0.05	2.07±0.08	2.06±0.06
0.75	0.125	0	5.61±0.22	4.68±0.28	3.86±0.37	27.26±1.77	30.79±1.49	31.19±1.56	2.11±0.03	2.07±0.03	2.04±0.05	2.11±0.03	2.07±0.03	2.04±0.05
0.75	0.125	0.25	5.77±0.25	4.80±0.37	3.97±0.35	28.45±1.41	29.43±2.04	30.66±1.75	2.12±0.02	2.09±0.07	2.06±0.03	2.12±0.02	2.09±0.07	2.06±0.03
0.75	0.125	0.50	5.86±0.33	4.97±0.26	4.10±0.28	27.81±1.62	28.51±1.68	29.23±1.89	2.13±0.01	2.10±0.06	2.09±0.02	2.13±0.01	2.10±0.06	2.09±0.02
0.75	0.125	0.75	5.71±0.41	4.83±0.29	4.06±0.24	28.51±1.53	29.60±1.41	30.89±2.09	2.10±0.11	2.08±0.02	2.08±0.07	2.10±0.11	2.08±0.02	2.08±0.07
0.75	0.125	1.00	5.64±0.27	4.71±0.30	3.81±0.31	30.63±1.89	30.25±1.39	31.30±1.86	2.08±0.04	2.07±0.02	2.06±0.05	2.08±0.04	2.07±0.02	2.06±0.05
1.00	0.25	0	5.53±0.33	4.57±0.33	3.78±0.26	31.26±2.11	33.84±1.28	34.51±1.42	2.09±0.03	2.07±0.03	2.05±0.05	2.09±0.03	2.07±0.03	2.05±0.05
1.00	0.25	0.25	5.70±0.38	4.69±0.28	3.90±0.43	29.70±1.67	30.35±1.51	31.90±1.90	2.11±0.08	2.08±0.11	2.07±0.06	2.11±0.08	2.08±0.11	2.07±0.06
1.00	0.25	0.50	5.81±0.20	4.88±0.21	4.07±0.35	28.33±1.38	29.16±1.70	29.64±2.06	2.12±0.02	2.10±0.05	2.09±0.03	2.12±0.02	2.10±0.05	2.09±0.03
1.00	0.25	0.75	5.67±0.19	4.47±0.37	3.86±0.26	29.51±1.63	31.79±1.88	31.88±1.74	2.10±0.05	2.09±0.07	2.06±0.04	2.10±0.05	2.09±0.07	2.06±0.04
1.00	0.25	1.00	5.59±0.35	4.63±0.29	3.72±0.40	30.86±1.80	32.23±1.42	33.14±1.51	2.09±0.02	2.08±0.06	2.04±0.04	2.09±0.02	2.08±0.06	2.04±0.04

*The number of each sample specimens was 5, S = Sodium lignosulfonate, M = Methylcellulose, V = Vinyl acetate.

Vita

Wichit Prakaypun was born on July 4, 1976 in Bangkok. He received a bachelor degree in materials science from Faculty of Science, Chulalongkorn University in 1996. He enrolled for his master study in March, 1996 and completed the program in April 1998.