Asian Journal of Chemistry; Vol. 25, No. 10 (2013), 5678-5680

ASIAN JOURNAL OF CHEMISTRY

http://dx.doi.org/10.14233/ajchem.2013.OH61

Study of Inorganic Waterproof Agent on the Performance of Desulfurization Gypsum Products†

YI DING[1,2], QIFANG REN[1,2,*] and PUHUA HU[1,2]

[1]College of Material and Chemical Engineering, Anhui University of Architecture, Hefei 230022, Anhui Province, P.R. China
[2]Anhui Key Laboratory of Advanced Building Materials, Hefei 230022, Anhui Province, P.R. China

*Corresponding author: E-mail: averly80@aiai.edu.cn; dyrqf@aiai.edu.cn

AJC-13303

Gypsum block is based on building gypsum as main raw material, by adding water mixing, casting molding and drying into light construction gypsum products. This experiment mainly studied plant desulfurization gypsum in adding inorganic waterproof agent on block setting time, apparent density, compressive strength, flexural strength and coefficient softening, finding a good water resistant agent and experimental formula. When the 25 % inorganic waterproof agent was added, the product apparent density is 1087 kg/m^3, compressive strength is 11.53 Mpa, flexural strength is 3.40 Mpa, soften coefficient is 0.63.

Key Words: Desulfurization gypsum block, Inorganic waterproof agent, Soften coefficient.

INTRODUCTION

Gypsum block used as wall materials (mainly for internal partition), with a light weight (per square meter is red brick wall weight 1/3), flame retardant, indoor air conditioning (cooling in summer and warming in winter), good anti-seismic performance characteristics[1]. However, the use of gypsum building products with common weakness is low intensity, poor waterproof, moisture-proof performance. Gypsum products have these flaws, which greatly hindered its development and use. Many scholars have done a lot of work on the waterproof gypsum[2-5]. In this paper, through the addition of inorganic waterproof agent to improve the desulphurization gypsum softening coefficient.

EXPERIMENTAL

All chemicals used in our experiments were purchased and used as received without further purification. Inorganic waterproof agent is mixed of 52.5 ordinary portland cement, fly ash, slag powder composites and the desulphurization gypsum is a powdered solid particles,which are mainly concentrated in the 30-60 μm, with a moisture content of about 10 %. Other performance parameters are as follows (Table-1).

In a typical procedure, a certain amount of plaster, in particular water cement ratio and add water mixing evenly, made into blocks, to be after the final setting on natural conditions of maintenance and then the softening coefficient of determination and test block compressive strength test.

TABLE-1
TECHNOLOGICAL PARAMETERS OF DESULPHURIZATION GYPSUM

Project	Index	Project	Index
Initial setting time	4 min	Final setting time	10 min
Flexural strength (2 h)	2 Mpa	Compressive strength (2h)	2.5 Mpa
SO_3 Content	45.6 %	CaO Content	33.42 %
SO_2 Content	0.42 %	MgO Content	1.08 %
Fe_2O_3 Content	0.32 %	AL_2O_3 Content	0.82 %

DKZ-5000/6000 type electric cement bending test machine and JYE-2000/3000 electro-hydraulic type pointer pressure test machine.

RESULTS AND DISCUSSION

The block apparent density of test data was shown in Table-2 and apparent density distribution is shown in Fig. 1.

Fig. 1 shows that with the addition of inorganic waterproof agent into the block, the apparent density increases gradually. The maximum increase in density obtained when

TABLE-2
APPARENT DENSITY TEST DATA

Serial number	Type	Content	Apparent density
O	No waterproof agent	0	1048 Kg/m^3
A	Inorganic waterproof agent	5 %	1053 Kg/m^3
B	Inorganic waterproof agent	15 %	1076 Kg/m^3
C	Inorganic waterproof agent	25 %	1087 Kg/m^3
D	Inorganic waterproof agent	35 %	1136 Kg/m^3

†Presented to the 6th China-Korea International Conference on Multi-functional Materials and Application, 22-24 November 2012, Daejeon, Korea

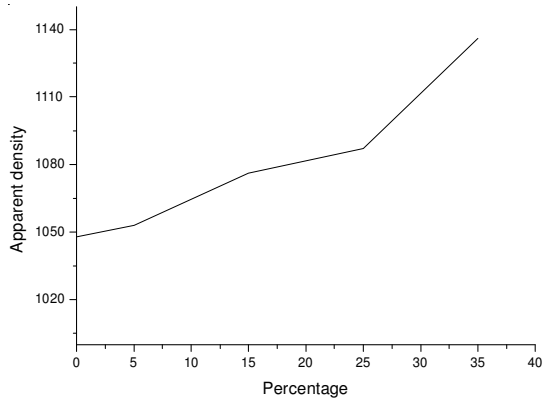

Fig. 1. Influence of inorganic waterproof agent on apparent density

inorganic waterproof agent content reaches 35 %. The density of the block has reached its peak: 1136 kg/m^3. The block of apparent density the block has been unable to meet the national standard JC/T 698-2010 (no more than 1100 kg/m^3). The data of the test block setting time as shown in Table-3.

TABLE-3
TEST BLOCK SETTING TIME

Serial number	Type	Content	Initial setting time	Final setting time
O	No waterproof agent	0	3 min 56s	9 min 42s
A	Inorganic waterproof agent	5 %	3 min 42s	9 min 24s
B	Inorganic waterproof agent	15 %	3 min 32s	8 min 56s
C	Inorganic waterproof agent	25 %	3 min 14s	8 min 37s
D	Inorganic waterproof agent	35 %	3 min 07s	8 min 05s

Table-3 shows that with the increase of the content of inorganic waterproof agent, the initial setting, final setting time of the block decreased gradually, meeting the national standard JC/T 698-2010.

The 2 h, 3 days, 7 days compressive, flexural strength data of the block were shown Tables 4 and 5.

Tables 4 and 5 show: (1) With curing period increasing, the test block of compressive strength, flexural strength was increased, before 3 days, the strength development rate was rapid, after 3 days, the strength development rate was slow. (2) For the same block, with the increase of the content of inorganic waterproof agent, the compressive strength, flexural strength of block showed a rising trend. When inorganic waterproof agent content reaches 35 %, the compressive and flexural strength of test block has reached the peak. And the four group of adding inorganic waterproof agent for gypsum block, 2 h strength can meet the national standard.

The 7 d dry flexural strength of the block, wet flexural strength after immersion 24 h and softening coefficient were shown in Table-6.

From the Table-6, the following conclusions can be drawn: (1) The waterproof material of gypsum block softening coefficient is only 0.34. (2) With the inorganic waterproof agent increasing, softening coefficient showed an upward trend, when inorganic waterproof agent content greater than 25 %, the block softening coefficient has reached 0.63, meet the national standard more than 0.6 requirements.

Conclusion

In summery, we have shown that through studying desulfurization gypsum in adding inorganic waterproof agent on block setting time, apparent density, compressive strength, flexural strength and coefficient softening, finding a good

TABLE-4
TEST BLOCK COMPRESSIVE STRENGTH

Serial number	Type	Content	Compressive strength (2h)	Compressive strength (3d)	Compressive strength (7d)
O	No waterproof agent	0	2.32 Mpa	5.65 Mpa	8.72 Mpa
A	Inorganic waterproof agent	5 %	2.75 Mpa	6.03 Mpa	9.37 Mpa
B	Inorganic waterproof agent	15 %	3.27 Mpa	6.46 Mpa	10.81 Mpa
C	Inorganic waterproof agent	25 %	3.91 Mpa	7.37 Mpa	11.53 Mpa
D	Inorganic waterproof agent	35 %	4.34 Mpa	8.00 Mpa	13.40 Mpa

TABLE-5
TEST BLOCK FLEXURAL STRENGTH

Serial number	Type	Content	Flexural strength(2h)	Flexural strength(3d)	Flexural strength(7d)
O	No waterproof agent	0	1.97 Mpa	3.05 Mpa	4.63 Mpa
A	Inorganic waterproof agent	5 %	2.03 Mpa	3.40 Mpa	4.97 Mpa
B	Inorganic waterproof agent	15 %	2.25 Mpa	3.73 Mpa	5.31 Mpa
C	Inorganic waterproof agent	25 %	2.38 Mpa	4.25 Mpa	5.58 Mpa
D	Inorganic waterproof agent	35 %	2.44 Mpa	4.52 Mpa	6.87 Mpa

TABLE-6
7 DAYS DRY FLEXURAL STRENGTH, WET FLEXURAL STRENGTH AND SOFTENING COEFFICIENT

Serial number	Type	Content (%)	Dry flexural strength (Mpa)	Immersion flexural strength (Mpa)	Softening coefficient
O	No waterproof agent	0	4.63	1.54	0.34
A	Inorganic waterproof agent	5	4.97	2.44	0.49
B	Inorganic waterproof agent	15	5.31	2.92	0.55
C	Inorganic waterproof agent	25	5.58	3.51	0.63
D	Inorganic waterproof agent	35	6.87	4.60	0.67

inorganic waterproof agent. When the inorganic waterproof agent was added to 25 %, the product apparent density is 1087 kg/m^3, compressive strength is 11.53 Mpa, flexural strength is 3.40 Mpa, soften coefficient is 0.63.

ACKNOWLEDGEMENTS

One of the authors (D.Y.) thank the financial support from the Natural Foundation of Anhui Province| Education Committee (Grant KJ2012A058), Anhui Usniversity of Architecture College Students Open Fund (Grant C12098) and National College Students' Innovation Fundation (Grant 201210878069).

REFERENCES

1. C.W. Xiang, The Handbook of New Building Decoration Materials. BeiJing: China Building Industry Press, vol. 10, p. 22 (1992).
2. L.Y. Li and Z.L. Shi, *New Build. Mater.*, **5**, 1 (2007).
3. J.Q. Li, G.Z. Li and G.H. Zhang, *J. Build. Mater.*, **10**, 137 (2007).
4. Z.G. Zhang, L.Y. Gao, L.F. Yang *et al.*, *Fly Ash Comprehensive Utilization*, **2**, 27 (2009).
5. M.R. Liu, G.Z. Li and Y.T. Ba, *J. Wuhan Univ. Technol.*, **31**, 23 (2009).