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水泥类型对含铝粉的外加剂作用的影响

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摘 要：0.5-1.5%
CEM I CEM III
OH-
CEM III CEM I 1%
CEM III
CEM III

关键词：

Influence of the Type of Cement on the Action of the Admixture Containing Aluminum Powder

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Abstract：The study of the effect of cement type on the action of an admixture increasing the volume of concrete (containing aluminum powder), used in amounts of 0.5–1.5% of cement mass, was presented. The tests were carried out on cement mortars with Portland (CEM I) and ground granulated blastfurnace slag cement (CEM III). The following tests were carried out for the tested mortars: the air content in fresh mortars, compressive strength, flexural strength, increase in mortar volume, bulk density, pore structure evaluation (by the computer image analysis method) and changes in the concentration of OH^- ions during the hydration of used cements. Differences in the action of the tested admixture depending on the cement used were found. To induce the expansion of CEM III mortars, a smaller amount of admixture is required than in the case of CEM I cement. Using the admixture in amounts above 1% of the cement mass causes cracks of mortars with CEM III cement due to slow hydrogen evolution, which occurs after mortar plasticity is lost. The use of an aluminum-containing admixture reduces the strength properties of the cement mortars, the effect being stronger in the case of CEM III cement. The influence of the sample molding time on the admixture action was also found.

Keywords：Aluminum powder; Concrete expansion; Portland cement; Ground granulated blast-furnace slag cement

一、引言

(2)

(3)

(1)

(4)
CO2

C4A3S-
C3A

Ca OH 2

0.1-1.0

pH pH
20% 80%

0.5-1.5%

二、材料和方法

40 × 40 × 160mm3

CEM I 42.5R CEM III/A
42.5N LH HSR NA w/c 0.5
PN-EN 196-1: 2006 /
1/3

0% 0.5% 1% 1.5%
EN 480-1

三、测试的范围包括：

1.
EN 1015-7: 1998
12
CEM III 1.0% CEM III 1.5% 30 45

2.

EN 1015-11: 2001
7 28 56 91
3
40 × 40 × 160mm3

四、体积密度

1.
2.
CEM I

OH- 1% CEM I

CEM III 0.5%

1%
CEM III
1.5% 1%

CEM III
30 45
12

五、水泥浆中 OH-离子的含量

CEM III

OH- 0.08
mol/dm3
OH-
0.065 / OH-

OH-

5 OH-

CEM III OH-

CEM I OH-

3-5 CEM I 2

CEM III OH-

0.06 mol/dm3 CEM I OH-

27% CEM III

OH- CEM I

CEM III OH- CEM I

六、砂浆的膨胀

1% 1.5%

CEM III CEM I

CEM I

CEM I

CEM I

CEM III

CEM III

1 1.5

0.5%

七、砂浆的体积密度

" "

1 1.5

CEM I

2.5

1%

1.5 1.5%

2

CEM III

40% 1%

CEM III

2 2 CEM

III 1.5%

4 4.24% 18.4%

1.5% CEM III

CEM I CEM III

SV CEM I

1.0% 1.5% SV

67% 162% CEM III

SV 2 227% 5

500% CEM I CEM III

SV

八、砂浆的抗压强度

0.5% 7

CEM I

8%

CEM I 0.5%

1% CEM I

16% 0.5-1.5%

f c CA

1.5% 28

56 91 28

1 1.5 EN 197-1

42.5

CEM III

0.5% CEM III

R2>0.95 CEM

III 0.5% 16%

91

九、砂浆的抗折强度

CEM III 7

CEM I 28 56 90

CEM I

CEM III

CEM III 7 CEM I CEM III

CEM I CEM III

CEM III

CEM I

CEM III

十、结论

CEM I CEM III

0.5 1.0 1.5%

1 CEM III CEM I

0.5% CEM III CEM I 0.5%

CEM III

2 OH-

CEM III

3 CEM III >1%

4 CEM III

CEM III CEM III 1.5%

50%

CEM III

CEM III 1.5%

46%

5

CEM III

参考文献

[1].Kalpana M, Mohith S. Study on autoclaved aerated concrete: Review, Materials Today. Proceedings 2020; 22: 2214–7853.

[2].Qu X, Zhao X. Previous and present investigations on the components, microstructure and main properties of autoclaved aerated concrete—A review. Constr. Build. Mater. 2017; 135: 505–516.

[3].Novais RM, Ascensão G, Ferreira N, et al. Influence of water and aluminium powder content on the properties of waste-containing geopolymer foams. Ceram. Int. 2018; 44: 6242–6249.

[4].Keawpapasson P, Tippayasam C, Ruangjan S, et al. Metakaolin-Based Porous Geopolymer with Aluminium Powder. Key Eng. Mater. 2014; 608: 132–138.

[5].Zhang Z, Provis JL, Reid A, et al. Geopolymer foam concrete: An emerging material for sustainable construction. Constr. Build. Mater. 2014; 56: 113–127.

[6].Wang F, Liu Z, Hu S. Early age volume change of cement asphalt mortar in the presence of aluminum powder. Mater. Struct. 2010; 43: 493–498.

[7].Kinoshita H, Swift P, Utton C, et al. Corrosion of aluminium metal in OPC- and CAC-based cement matrices. Cem. Concr. Res. 2013; 50: 11–18.

[8].Goual MS, Bali A, de Barquin F, et al. Isothermal moisture properties of Clayey Cellular Concretes elaborated from clayey waste, cement and aluminium powder. Cem. Concr. Res. 2006; 36: 1768–1776.

[9].Muthu Kumar E, Ramamurthy K. Effect of fineness and dosage of aluminium powder on the properties of moist-cured aerated concrete. Constr. Build. Mater. 2015; 95: 486–496.

[10].Damene Z, Goual MS, Houessou J, et al. The use of southern Algeria dune sand in cellular lightweight concrete manufacturing: Effect of lime and aluminium content on porosity, compressive strength and thermal conductivity of elaborated materials. Eur. J. Environ. Civ. Eng. 2018; 22: 1273–1289.

[11].Balasubramanian R. Development of sandwich panels combining aluminium powder-cement composites lightweight concrete. Int. J. Adv. Res. Ideas Innov. Technol. 2019; 5: 49–52. 21.