

Influence of Fly Ash Loss on Ignition on Strength and Durability Characters of Blended Cement Paste

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Abstract The influence of fly ash loss on ignition on some materials properties of fly ash blended cement paste would be discussed. LOI was changed continuously by 8%, 15% and 20%. The results when cement versus HFA was 0.2 by mass, and LOI content was 20%, the all characteristics showed the poorest results which strength, max dry shrinkage and expansion strain were 2MPa, 1052 and 708×10^{-6} (mm/mm).

Key words fly ash loss on ignition; fly ash; compressive strength; shrinkage; sulfate attack

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1 Experimental

It is also known that not only the strength of cement based products, but its durability is important to increase the service life of the structure. Research on this kind of FA with high LOI (HFA) value varying from 10% to 30% is a hot issue^[1-4].

1.1 Materials

Fly ash The FA was produced in local power plant and corresponds to ASIM class C. Cement commercially available ordinary Portland cement equivalent to ASIM Type I.

1.2 Mix details

Keeping the ratio FA to cement as 100:20 and 100:30, six kinds of mixes were prepared with a 0.35 water-total solid ratio (w/s). CS, CM and CH are the serial number, in which C means Ordinary Portland Cement I and S, M, L means three levels of LOI and equals to 8%, 15%, 20%.

1.3 Test and analysis details

The strength test was done at the age of 3, 7, 28 and 90 days in accordance with the ASIM C109.

2 Results and discussions

2.1 Compressive strength

The results of the compressive strength of pastes are given in table 1. With increasing dosage of cement, samples 7 d and 28 d compressive strength were getting increase under same LOI of HFA. This might due to the available water solid ratio which controlled hydra-

tion of cement pastes increased after increased HFA substitution.

Tab 1 Results of compressive strength test

Compressive strength with 100% RH at 20°C / MPa					
LOI	8%	4.04	6.28	7.44	10.06
	15%	4.02	5.33	6.32	7.88
	20%	3.48	4.92	5.08	6.92
NC sample compressive strength with 100% RH					
		29.21	42.48	52.74	

2.2 Drying shrinkage

The results of drying shrinkage of the pastes bars are shown in Table 2. It could be concluded that the higher water requirement, the more distinct the dry shrinkage of the samples showed.

Tab 2 Results of dry shrinkage

Samples	Dry shrinkage strain/ 10^{-6}			
	3d	7d	28d	90d
CS1	182	357	802	873
CM1	322	567	875	924
CH1	414	554	1000	1052
CS2	291	537	729	815
CM2	333	548	754	852
CH2	402	528	956	998
NC	325	578	845	912

2.3 Resistance of sulfate attack

The results of the expansion test of the pastes bars subjected to Na_2SO_4 solution are shown in Table 3. It is evident that the incorporation of all fly ashes except the CS_1 , CS_2 reduced the expansion of the pastes bars compared to NC sample.

Tab 3 Results of the expansion				
Samples	Expansion strain / 10^{-6}			
	7d	14 d	28d	90 d
CS_1	66	84	120	212
CM_1	78	155	216	438
CH_1	92	147	378	612
CS_2	54	78	125	192
CM_2	81	112	208	402
CH_2	85	135	362	588
NC	102	134	168	287

2.4 Hydration degree of HFA

From fig. 1 it is obvious that with increasing curing time, the hydration degree of HFA increased at different rate. In early period hydration degree showed nearly no changes while sharply increased at 28 and 60 days. It showed that at first 7 days curing, the hydration degree increased slowly while rapidly increased after 28 days curing.

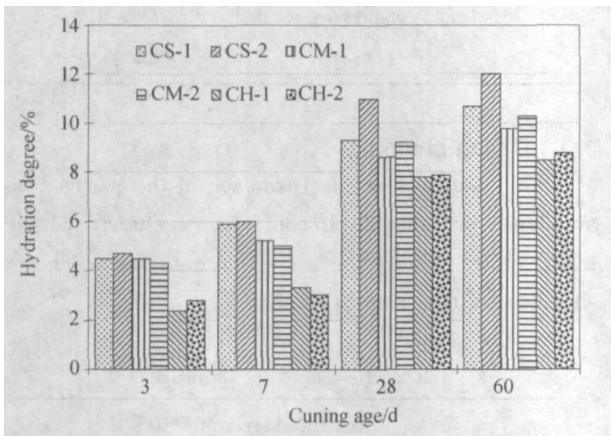


Fig 1 Hydration degree of pastes

3 Conclusions

With increasing LOI content, it led to lower compressive strength, higher dry shrinkage and expansion, and slow down the hydration process. When cement versus HFA was 0.2 by mass, and LOI content was 20%, the all characteristics showed the poorest results which strength, max dry shrinkage and expansion strain were 2 MPa, 1 052 and 708×10^{-6} (mm/mm). By increasing cement dosage or decreasing LOI content would lead to the better results. Grey incidence analysis showed LOI content was much more influential to expansion of samples which were attacked by sodium sulfate; however, cement dosage was much more influential to strength, dry shrinkage, and hydration degree at same time. It would be concluded that about 10% LOI content of FA was suitable and those which was much more than 10% LOI content would be rejected to be used in any construction due to its poor strength and durability.

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高烧失量粉煤灰对水泥浆体的力学和耐久性能的影响研究

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摘 要: 探讨了粉煤灰的烧失量对水泥复合粉煤灰浆体的力学和耐久性能的影响。当水泥粉煤灰质量比为 0.2 且所选用的粉煤灰烧失量为 20% 时, 各项性能表现出最差的结果, 分别为 7d 抗压强度仅为 2 MPa, 28d 强度也仅为 3.92 MPa, 最大干缩和膨胀应变为 1.052×10^{-6} 和 708×10^{-6} ; 各龄期内粉煤灰的水化程度也相当低。

关键词: 高烧失量粉煤灰; 抗压强度; 干缩; 硫酸盐侵蚀

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