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MECHANICAL PROPERTIES OF HIGH PERFORMANCE CONCRETE MADE WITH HIGH CALCIUM HIGH SULFATE FLY ASH

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ABSTRACT

A high calcium fly ash with high SO_3 content was used to produce high performance concrete. In all the mixes, the fly ash contents of 50% and 60% by weight were applied. Although fly ash cement pastes showed severe volume unstability and poor pore structure development, mortars and concretes incorporating high mass high calcium fly ash exhibited good performance in both fresh and hardened state as those with low calcium fly ash did. The 3d and 28d compressive strength of mortars reached 25.2 ~ 42.2MPa respectively with the water binder ratio varying from 0.30 to 0.24. What is noticeable is that all the mortars and concretes showed good strength developing tendency with the 90d compressive strength up to 67.3 ~ 85.5MPa. This investigation reveals once more the fact that some materials which are not up to standard can still play a special role so long as the components are carefully chosen and proportions properly designed. © *1997 Elsevier Science Ltd*

Introduction

For half a century researchers have studied the chemical compositions and physical properties of all kinds of fly ashes and their usage in concretes (1-6). Because of the inherent variability of the ashes due to the different sources, geological history and processing methods, the use of fly ash in concretes has been very cautious. Generally, fly ash as a cementitious component, its SO_3 content should not be too high, say, 3% is the upper limitation on Chinese specification GB1596-91, otherwise the formation and development of ettringite (AFt) in concrete may cause expansion and cracking and thus worsen the properties of concrete. Particularly, when we want to mix high performance concrete, the use of unqualified materials is generally regarded as undesirable.

Literatures showed that high volume fly ash cement pastes had a more porous structure at early curing ages than pure cement pastes did, however, the structure grew denser and denser as time went on (7,8). From this point of view, porous structure does no good to the development of early strength for ordinary concrete, but it is no doubt that the development of crystals or expansive substances in porous condition shall densify the matrix. On the basis of the view, the high calcium fly ash with high SO_3 content was employed to mix high per-