Comparative Performance of Beneficiated Run-of-Station Fly Ash as Cement

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ABSTRACT

In the drive towards ever cleaner coal-fired power stations, producers in many countries have modified furnace conditions. Although this is both laudable and necessary, given government regulations, these changes generally affect negatively the quality of fly ash (FA) produced (usually termed as run-of-station ash). In particular, particle size is coarsened and/or residual carbon content increased. These impact significantly on the water reducing ability and reactivity of FA and, in extreme cases, the ash cannot be used as a cement component. Given that this is the premium use for the material, a number of beneficiation methods have been developed and are being adopted by an increasing number of producers to enhance ash quality and ensure outlet to the cement market, with the concomitant economic benefits. Whilst there has been a significant amount of research and development work on processing techniques themselves and the characteristics of the ash obtained, there is limited data on the comparative performance of these materials in cementitious mixes.

This paper considers a range of methods to control the physical and/or chemical characteristics of FA and the effect of these on the performance of processed FA in cementitious mortars. Three types of FA processing have been investigated, namely (i) air-cyclone classification, (ii) thermal treatment at 600°C and 900°C and (iii) mechanical grinding. Comparative performance has been measured using mortars with FA contents of 15%, 30% and 45% by mass of cement. The main focus of the study reported will be on particle packing density of Portland cement/FA mixes and the key fresh, hardened and durability properties. Data will be presented on mortar workability, compressive strength development, initial surface absorption, porosity and chloride ingress and it will be demonstrated that, although all are beneficial, there are significant differences in performance of FA produced by the different processing methods. It is hoped that the paper will encourage further consideration of run-of-station beneficiation methods to increase the utilisation of this advantageous material in premium cementitious applications.

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