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Discussion

A reply to the discussion by H. Un of the paper "Use of zeolite, coal bottom ash and fly ash as replacement materials in cement production" [Cem. Concr. Res. 34 (5) (2004) 731–735]

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The authors would like to thank Mr. H. Un for his discussion of our paper and wish to make the following comments in reply.

In our study, we examined the effects of natural pozzolan, zeolite (Z), and coal bottom ash (BA) and fly ash (FA) as portland cement replacement materials on the properties of cement, which were investigated through three different combinations of tests. Our paper [1] mainly focuses on the usability of those pozzolans in cement production.

A pozzolan is defined as a siliceous or siliceous and aluminous material which in itself possesses little or no cementing property but will chemically react with calcium hydroxide at common temperatures to form compounds possessing cementitious properties in finely divided form and in the presence of moisture [2]. Any pozzolanic substance that interferes with crystal formation and interbonding is bound to influence the overall cohesive strength of the cement. Mechanical interlocking plays a significant role in chemical forces during crystal formation and developing [3]. Portland cement substitution by supplementary mineral additives such as natural pozzolan, coal fly ash, ground-granulated blast-furnace slag, silica fume, rice-husk ash, and wood fly ash, regarded as an economically viable and an environmentally friendly alternative [4,5].

Natural zeolite contains large quantities of reactive SiO_2 and Al_2O_3 [6]. Zeolite is similar to other pozzolanic materials such as silica fume and fly ash. Zeolite substitution can improve the strength of concrete by the pozzolanic reaction with $CaOH_2$.

In this study, the physical properties of zeolite (Z), coal bottom ash, (BA), fly ash (FA), and their effects on the mechanical properties of cement were examined. The results indicate that the combination of zeolite, fly ash, and coal bottom ash can result in significant improvements in the properties of cement mortar and the strength of hardened cement mortar.

The test results on the physical properties of optimized blended cements and control of ordinary portland cement (R), PC 42.5, together with TS 10156 [7] requirements, were summarized in Tables 2 and 3. The fineness of the blended cements was higher than that of ordinary portland cement (R). The fineness increased with amount of total mineral additives. This is mainly due to the high fineness of zeolite (Z). TS 10156, ASTM C 595, and ASTM C 1157 did not specify a limit on fineness of blended cements.

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