Blended Fly Ash Cement

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ABSTRACT

In the past few years, the demand for portland cement has increased due to expanding construction activity worldwide, while production of cement has not increased noticeably. High capital costs and stricter environmental regulations have slowed the expansion of cement production, which in turn has lead to a scarcity of cement, and increased prices. In the United States, also there has been increase in the price of portland cement.

The production of cement is highly energy intensive, consuming large amounts of energy (approximately 6.5 million BTU per ton of cement) and producing large amounts of green-house gases (about one ton of CO_2 per ton of cement produced). The most attractive means of increasing cement production is one which can be done with minimal amounts of additional energy required and minimum pollution created. Several industrial by-products are available which have been proven to be suitable for use in blended cements production. They can be used to supplement portland cement with very small amount of additional processing energy required, if blended carefully.

The idea of producing blended cements using industrial by-products is not new. Many research projects have been conducted in this area since the 1950s. Outside the U.S., blended cement production has expanded rapidly in the past decade or so. Currently, in most European and Asian countries, over 20% of cement production is blended cement.

Blended cements are hydraulic binders in which a part of portland cement is replaced by other hydraulic or non-hydraulic materials. Blended cements having both pozzolanic and latent hydraulic binder can develop strength comparable to portland cement binder alone. They ensure maximum service life due to: (i) low permeability, (ii) improved chemical resistance, (iii) reduced risk of alkali-aggregate reaction, and (iv) minimized the risk of early thermal shrinkage cracking. Therefore, blended cements produce durable concrete structures.

Blended cements are obtained by adding inorganic mineral components to the portland cement clinker and gypsum. These additional components are: (i) ground granulated blast furnace slag (GGBFS), (ii) fly ash, (iii) micro-silica, (iv) blast furnace slag, (v) lime stone, (vi) natural pozzolans, (vii) RHA, and (viii) metakoaline, etc