Using ggbs for partial cement replacement in concrete: Effects of water-binder ratio and ggbs level on activation energy

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Abstrak

Ground granulated blast furnace slag (ggbs) is a waste material generated from iron production, and is one of the cementitious materials that can be used to replace part of the cement in concrete. The aim of this research was to determine the effects of the water-binder ratios and levels of ggbs in concrete, with regard to the activation energy, which is needed for predicting the concrete's strength. A number of mixtures with different water-binder ratios (ranging from 0.30 to 0.51), ggbs levels, and curing temperatures were cast and tested at 0.5, 1, 2, 4, 8, 16, and 32 days. The activation energies were determined using the American society for testing and materials (ASTM) standard C1074, and the Freiesleben Hansen and Pedersen (FHP) method. The results of the experiment showed that the apparent activation energy was relatively independent of the water-binder ratio, and mainly affected by the ggbs level in the concrete. Higher ggbs levels in the concrete resulted in the higher apparent activation energies.