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Properties of High Volume Glass Powder Concrete

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Abstract

Mechanical and durability properties of concrete with cement replaced by finely grounded glass powder in high volume up to 60% were investigated. XRD and TGA analyses indicated that the fine glass powder reacted with calcium hydroxide to form calcium-silicate-hydrates. As such, the microstructures of concrete were more compact and homogeneous, especially at the interfacial transition zone. Concrete with cement replaced by 15% and 30% glass powder exhibited the highest strength increase and correspondingly the lowest porosity. Beyond a replacement of 30%, calcium hydroxide became insufficient for the pozzolanic reaction of glass powder. However, the high volume glass powder concrete retained distinct resistance against water and chloride ingress, due to the reduction in pore size and connectively. Reductions of 77%, 83%, 96%, 91% and 92% were observed respectively for water penetration depth, sorptivity, conductivity, chloride diffusion and migration coefficients in concrete with cement replaced by glass powder by 60%.

Keywords: Compressive Strength; Durability; Interfacial Transition Zone; Microstructures; Pozzolanic Reaction; Recycling.