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Durability Performances of Epoxy Resin/TiO_2 Composited Alkali-Activated Slag/Fly Ash Pastes in Phosphoric Acid Solution

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Abstract : Laden with phosphates at a low pH value, sewage wastewater aggressive environments constitute a great threat to concrete-based pipes which is made of alkaline cementitious materials such as ordinary Portland cement (OPC). As a promising alternative for OPC-based binders, alkali-activated slag/fly ash (AASF) cementitious binders are generally believed to gain similar or better properties compared to OPC-based counterparts, especially durability. However, there is limited research on the performance of AASF binders in phosphoric acid solution. Moreover, the behavior of AASF binders composited with epoxy resin/TiO_2 when exposed to acidic media has been rarely explored. In this study, the performance of AASF paste with the precursor slag:fly ash (50:50 in mass ratio) enhanced with epoxy resin/TiO_2 composite in phosphoric acid solution (pH = 3.0-4.0) was investigated. The exposure towards acid attack lasted for 90 days. The same AASF mixture without resin/TiO_2 composite was used as a reference. The compressive strength and porous-related properties prior to acidic immersion were tested. The mass variations and degradation depth of the two mixtures of binders were also monitored which is based on phenolphthalein-videomicroscope method. The results show that the binder with epoxy resin/TiO_2 addition gained a higher compressive strength and lower water absorption than the reference. In addition, it also displayed a higher resistance towards acid attack indicated by a less mass loss and less degradation depth compared to the control sample. This improvement can be attributed to a dense microstructure evidenced by the higher compressive strength and related porous structures. It can be concluded that the microstructure can be improved by adding epoxy resin/TiO_2 composite in order to enhance the resistance of AASF binder towards acid attacks.

Keywords : alkali-activated paste, epoxy resin/TiO_2, composites, mechanical properties, phosphoric acid
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