

Effect of Accelerated Sulfate Attack in Geopolymer Concrete

Kunal Kupwade-Patil, Erez N. Allouche, Courtney Alyssa Watts,
Shathabish NaraseGowda

¹600 W. Arizona Ave, Alternative Cementitious Binders Laboratory, Louisiana Tech University, Ruston, LA-71272

KEYWORDS: Fly Ash, Geopolymer Concrete (GPC), Sulfate Attack

ABSTRACT

Microstructural degradation induced by sulfate attack in Ordinary Portland Cement (OPC) is a cause of primary concern in building foundations and other infrastructures. Studies were conducted using two class "F" and one class "C" fly ash based geopolymer concretes (GPC) and was compared to OPC (Type I and V) counterparts. Durability tests were performed to examine the effect of external sulfate attack on geopolymer concrete (GPC) using calcium, sodium and magnesium sulfates. The sulfate ingress treatment was accelerated using applied electro kinetics by applying a constant current density of 1 A/m² for one week. Fly ash based GPC specimens suffered strength loss due to sodium and magnesium sulfates, whereas an increase in strength was observed in the presence of calcium sulfates. In comparison to the GPCs, OPC Type V cement exhibited superior resistance to all the three sulfates (CaSO₄, MgSO₄, and NaSO₄). Microstructural, chemical and pore structure studies were conducted using Scanning Electron Microscopy, X-Ray Diffraction (XRD) and BET analysis. These findings indicate that ettringite along with the formation of gypsum was responsible for expansion in GPC and OPC concretes. Geopolymer concrete mortars performed satisfactorily when exposed to the three sulfate sources, but did not outmatch the performance of OPC Type V cements.