Effect of alkali-activator solution-to-binder ratio on fresh and hardened mortar characteristics of low calcium geopolymer mortar for concrete sewer rehabilitation

Piumika Waswani Ariyadasa[1]
Allan Manalo[1], Weena Lokuge[1], Vasanthadevi Aravinthan[1] and Andreas Gerdes[2]
[1] University of Southern QLD
[2] Karlsruhe Institute of Technology

Geopolymers (GP), known for their sustainability, superior mechanical properties, and acid resistivity, are gaining attention in developing coating materials for sewer rehabilitation and repair. This paper presents a study mainly focused on developing a novel alkali-activated GP mortar employing low calcium fly ash (FA) as the sole binder and assessing its suitability for pipe coating applications benchmarking with Ordinary Portland Cement (OPC) mix and a proprietary geopolymer pipe coating product (P-GP). The influence of varying alkali-activator solution-to-binder weight (AAS/b from 0.4-0.55) on flowability, setting time, mechanical properties, and microstructure of FA-GP mortars were investigated. At ambient temperatures, the novel FA-geopolymer mortar formulated at the water, sand and AAS ratio to the binder weight of 0.35,1.5 and 0.55, respectively, behaved similarly to the OPC mortar mix at 0.45 water in terms of flow and setting time. In contrast, the fresh P-GP mortar mixed at 0.2 water was dry and undesirable for spray applications. The 28-day compressive strength of the FA-GP mix showed 41.9 MPa, meeting the strength threshold for cementitious structural repair mortars. 40 MPa. This implies that FA-based GP could manufacture sprayable structural grade mortar by adjusting the AAS in the mix and benchmarking with OPC.