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ELUCIDATING THE EFFECTS OF NANOSILICA ON THE CHARACTERISTICS OF ALKALI-ACTIVATED THIN-FILM TRANSISTOR LIQUID-CRYSTAL DISPLAY WASTE GLASS

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Abstract

Thin-film transistor liquid-crystal display (TFT-LCD) waste glass can be used as a raw material for producing geopolymers, because it contains large amounts of silicon and aluminum in its amorphous structure. The setting time and compressive strength were evaluated to determine the quality of the geopolymer product with various amounts of nano-SiO₂ (0%–3%) and TFT-LCD waste glass replacement (0% - 40%). The microstructures of the samples were characterized using mercury intrusion porosimetry (MIP), Fourier transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM). The highest compressive strength and compact microstructure of the geopolymer was attained by adding 10% waste glass and 1% nano-SiO₂. The results demonstrated that adding nano-SiO₂ to the geopolymer substantially enhances compactness, improves uniformity, and greatly increases compressive strength. This work offers a low-cost route for fabricating geopolymers, because TFT-LCD waste glass can be used to partially substitute metakaolin in the composition of the geopolymer.

Key words: compressive strength, geopolymer, microstructure, nano-SiO₂, TFT-LCD waste glass

Received: June, 2013; *Revised final:* June, 2014; *Accepted:* June, 2014; *Published in final edited form:* February 2018

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