

Hydration of Hardened Cement Paste Incorporates Nano-Palm Oil Fuel Ash at Later Age: The Microstructure Studies

ABSTRACT

Cement replacement using pozzolanic materials in nano-sized particles could improve the mechanical and durability of concrete. A study on the hydration of cement in hardened cement paste (HCP) could assist the investigation of nano-POFA (nPOFA) as a potential supplementary cementing material (SCM). Hence, the present work aims to examine the hydration of HCP incorporates nPOFA and the pozzolanic activity of nPOFA in cement matrix through the microstructure studies. A set of nPOFA-HCP were prepared with a cement replacement in range of 10-60% and the paste were cured for 90 days. The microstructural investigation of nPOFAHCP was conducted via X-Ray diffraction (XRD) analysis, Field Emission Scanning Electron Microscope (FESEM) analysis, Thermogravimetric (TG) analysis and Fourier Transform Infrared (FTIR) spectroscopy analysis. The diffractogram show the calcium hydroxide (CH) peak at at $2\theta = 18.1^\circ$ and 34.0° in 30nPOFA and 40nPOFA HCP is low compare than other pastes. The 30nPOFA and 40nPOFA give a low value of the relative loss weight of CH at later age through the TG analysis. Meanwhile, the morphology study display 30nPOFA and 40nPOFA HCP possess a dense and compact microstructure. FTIR analysis study the peaks of O-H symmetric stretching, C-O asymmetric stretching, Si-O asymmetric stretching and C-O bending stretching. Overall, the findings reveals the presence of nPOFA in cement matrix enhance the microstructure of cement matrix through the acceleration of cement hydration and the pozzolanic reaction. The cement replacement up to 40% with nPOFA could give an optimum result to produce a better cement-based products.