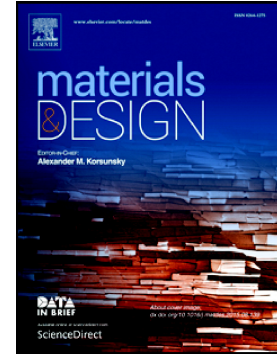


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Compressive strength prediction of nano-silica incorporated cement systems based on a multiscale approach

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Abstract

Effect on strength characteristics of nano-engineered concrete when cement content is replaced with nano-silica at small replacement levels is analysed experimentally and numerically in this paper. The reactivity of nano-silica within the cement paste is quantified through investigating microstructural images of cement pastes. A multiscale finite element model based on quantification of microstructural image analysis is developed to predict the compressive strength of the nano-modified system. Representative Volume Elements (RVEs) of the cement/nano-silica systems are developed at three different length scales; for the micro-level, meso-level and macro-level. Experimental analyses conducted for cement paste, mortar and concrete are used to validate the model predictions. The numerical modelling and experimental investigations reveal that the optimum replacement content of cement with nano-silica is around 8wt% for maximum strength enhancement.

Keywords: nano-silica; multiscale; compressive strength

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