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THE SYNERGIC EFFECTS OF NANO ADDITIVES ON THE MECHANICAL PROPERTIES OF GREEN LIGHTWEIGHT CONCRETE

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Abstract – Concrete materials have been commonly used in building and construction industries. However, the process of cement manufacture has long been connected with high consumption of energy and adverse environmental impacts. In this study, in order to produce innovative green concrete material that consumes lower energy, resources and is more eco-friendly, industrial waste by-product fly ash cenosphere has been utilized as lightweight aggregate to replace cement by 73.3 %. In most conducted researches regarding lightweight concrete (LWC) with cenospheres, attempts have been made to improve its physicomechanical properties by the inclusion of fibre materials, while limited studies have been performed to investigate the effects of nano additives, especially the synergic influence of them. Therefore, carbon nanotubes (CNTs) with the dosage of 0.05 %, 0.15 %, 0.45 % and nano silica (NS) with the content of 0.2 %, 0.6 %, 1.0 % by cement weight were used in this study as reinforcing fillers on the LWC. Experiments including flexural strength test, compressive strength test, water absorption and thermogravimetric analysis were carried out to evaluate the mechanical behaviors and the hydration characteristics of the produced LWC. Based on the experimental outcomes, the incorporation of CNTs and NS can effectively enhance both the flexural and compressive strength and reduce the absorbed water weight. The results from the thermogravimetric analysis reveal that the binary presence of CNTs and NS exerts positive impacts on the cement hydration reaction.

Keywords – Carbon nanotubes; compressive strength; fly ash cenospheres; flexural strength; nano silica; thermogravimetric analysis; water absorption