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S. Alrekabi, A. B.Cundy, A. Lampropoulos, Raymond L.D. Whitby, I. Savina

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Mechanical performance of novel cement-based composites prepared with nano-fibres, and hybrid nano- and micro- fibres

S. ALREKABI¹, A. B.CUNDY^{2*}, A. LAMPROPOULOS¹, RAYMOND L.D. WHITBY³, I. SAVINA⁴,

¹ School of Environment and Technology, University of Brighton, UK

¹ Dept. of Civil Engineering, University of Babylon, Babylon, Iraq

² School of Ocean and Earth Science, University of Southampton, UK

³ School of Engineering, Nazarbayev University, Astana, Kazakhstan

⁴ School of Pharmacy and Biomolecular Sciences, University of Brighton, UK

Abstract

Use of hybrid fibre composites that exploit the synergistic effect of nano- and micro-additives can potentially lead to significant improvements in the toughness and mechanical properties of fibre reinforced cementitious materials. In this study, the mechanical properties of two types of novel cementitious composite (Carbon Nano-Fibre (CNF) Composites, and Hybrid-Fibre Composites) at various curing ages have been evaluated, along with their microstructure. Experimental results show a positive impact of nano-fibres on the mechanical performance of the cementitious composites: improvements of 40% in flexural strength, 45% in tensile strength, and 85% in toughness were observed when a low mass % (0.025%) of CNFs was combined with steel fibres. SEM observations revealed that reinforcement at the nanoscale prevented nano-crack development within the composites, with a greater amount of energy required to initiate and propagate cracks and cause material failure.

*Corresponding author, (023)80596179. Email: A.Cundy@soton.ac.uk (Andy Cundy)

Keywords— Carbon fibres; hybrid composites; reinforced concretes; nanocomposites.

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