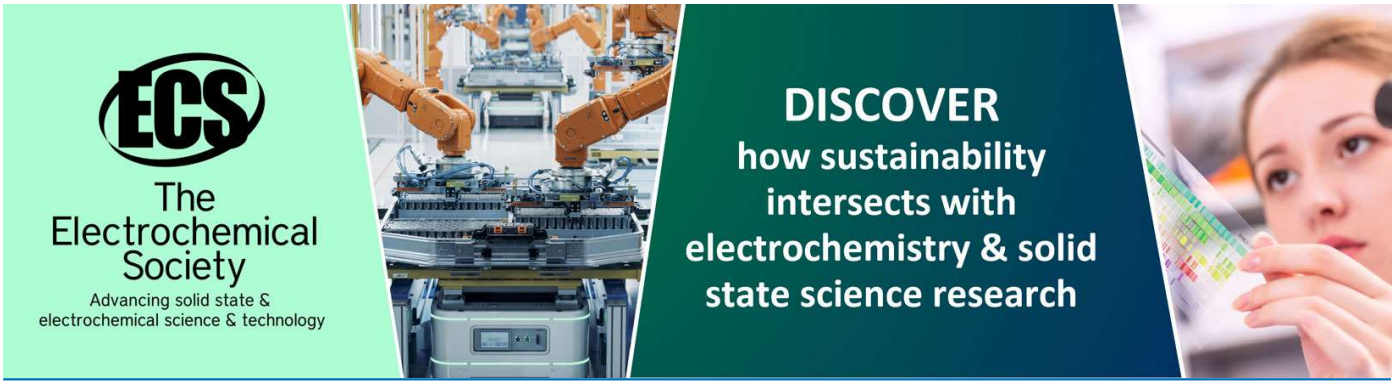
Strengthening of Cement mortar by Reinforcing Carbon Based Nano Material



Strengthening of Cement mortar by Reinforcing Carbon Based Nano Material

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Abstract. The present study reported the mechanical behaviour of reduced Graphene Oxide infused in cement mortar. In this investigation initially well graded Graphene Oxide confirming the presence of carbon functional group by FTIR Spectro results it is dispersed in suitable dispersion agent to obtain reduced Graphene Oxide [rGO]. The reduced Graphene Oxide was ultrasonicated with different hours of sonication at 1, 2, 4 and 6hours to reduce the oxygen functional groups. A series of cement mortar composite with varying percentages of reduced Graphene Oxide were prepared to achieve maximum strength by examining the compressive strength for different curing periods. The mechanical test results revealed that the composite containing reduced Graphene Oxide with 0.1% dosage showed good dispersion and well compressive strength prepared for 28 days than the plain cement mortar composite with 4hour sonication time. The strength of cement mortar prepared decreased after the time of sonication amplified from 4hours to 6hours due to interfacial bonding between the cement paste decreased. This study delivers a valued influence toward better understanding of the influence of reduced Graphene Oxide particle size on the properties of cementitious composites to optimize their performance.

Keywords: reduced Graphene Oxide [rGO], X-ray diffractogram, Raman Spectra, Ultrasonication, Compressive strength.

1. Introduction

Cement is the most important and one among widely used construction materials in the society due to its economical, good physical, chemical and mechanical properties. Nonetheless, because of its low tensile strength, heat of hydration, and strain capacity, it is only suitable for structural applications that do not require reinforcement. Tensile strength is low owing to pre-existing defects. Using reinforcement such as steel, fibres, and so on, it is possible to prevent the emergence of micro cracks and therefore enhance tensile stress resistance. Recent advancement in nanoscience and nanotechnology was produced many nanomaterials like TiO_2, ZnO. Go etc for many application like sensors, electronic devices, hydrogen generation. Reinforcement in concrete-based material. Introducing nanomaterial in cement based nanocomposites helps improve the hydration process. This motivated to study the reinforcement of nanomaterials in cement-based material, also by modifying their structure at nanoscale it will helps in improving their macro structure and mechanical properties of the cement. Recent studies revealed that extensive research is being conducted on the reinforcement of carbon-based materials such as graphene Oxide (GO), reduced Graphene Oxide (rGO), Carbon Nano Tubes (CNTs), and Multi Walled Carbon Nano Tubes (MWCNTs) in cement-based nanocomposite and their properties are being reported. These might be utilized as reinforcements in inhibit the formation and delay the propagation of micro cracks . Nano fibres have been found to be more effective than ordinary steel fibres in improving the mechanical performance of cementitious materials because they help to restrict cracks before they develop into micro cracks. The use of Nanoparticles contributes to making of small crystals such as Ca $(OH)_2$ and constant agglomeration of C-S-H products. This will also contribute in accelerating pozzolanic reactions which consumes Ca $(OH)_2$ and produce added C-S-H gel which helps