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Experimental study of the effects of graphene oxide on microstructure and properties of cement paste composite

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Abstract

Graphene oxide (GO) has been utilized to strengthen composite materials. In this study, the effects of GO on hydration degrees, macro-mechanical strength and calcium-silicate-hydrate (C-S-H) structure of cement based composites were investigated through comprehensive experimental tests. In addition, the aggregation mechanism of GO was verified by alkaline solution simulations, using $\text{Ca}(\text{OH})_2$ and $\text{NH}_3 \cdot \text{H}_2\text{O}$. Based on the experimental results, it was found that the 3-day and 7-day compressive strengths of cement based composites with 0.2 wt% of GO were increased by 35.7% and 42.3%, respectively as compared to the control. Moreover, the C-S-H structure of cement paste with GO was not observed to have undergone any change via qualitative and quantitative analyses combined with FT-IR, XRD and ^{29}Si -NMR. Besides, the test results of TGA, DTG and ^{29}Si -NMR showed that the hydrated degree of cement paste increased to 10.4% at 28 days when incorporating with 0.1% of GO.

Keywords: Graphene oxide (GO); Cement based composites; Hydration and microstructures; calcium-silicate-hydrate (C-S-H).

Abbreviations

GO graphene oxide

C-S-H calcium-silicate-hydrate

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