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Positive synergistic effect of graphene oxide/carbon nanotube hybrid coating on glass fiber/epoxy interfacial normal bond strength

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ABSTRACT: As coating material for micro-sized fibers, carbon nanotubes (CNTs) are effective in enhancing interfacial bonding due to their anchoring role while are easy to strip off from fiber surfaces; comparatively, graphene oxide (GO) is less effective in enhancing interfacial bonding but can be tightly adhered on fiber surfaces due to its encapsulating role. In this work, simultaneous grafting of CNTs and GO onto glass fibers (GFs) is conducted to combine their advantages and examine their synergistic effect. The contact angle measurement on fiber surfaces indicates that the GO/CNT hybrid coating leads to a significant increase in wetting property of GF surfaces with epoxy resin. As a result, the transverse tensile strength as an indication of interfacial normal bond property of glass fiber/epoxy composites is greatly enhanced by the GO/CNT hybrid coating. As a comparison, GO and CNTs are also coated separately on GFs. The enhancement in the interfacial normal property is in the order of GO/CNT > CNT > GO coating. Furthermore, the interfacial bond property by the GO/CNT hybrid coating layer is shown to be significantly higher (128%) than the calculated value in terms of the rule of mixtures from the results of single GO and CNT coatings, indicating that the GO/CNT hybrid coating displays a great positive synergistic effect on glass fiber/epoxy interfacial normal bond strength. Consequently, the present methodology is a promising approach for effectively improving fiber-matrix interfacial bond property in multi-scale composites.

Keywords: Composite; Interfacial property; Surface treatment; Graphene oxide; Carbon nanotube

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