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A bio-surfactant for defect control: multifunctional gelatin coated MWCNTs for conductive epoxy nanocomposites

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Abstract:

To simultaneously improve mechanical and electrical properties for polymers via addition of appropriate nanomaterials, such as carbon nanotubes (CNTs), can be realized only if an effective treatment method for CNTs is applied. Here, we report a study of using gelatin, an environmental friendly and abundant protein with rich functional groups, as a bio-surfactant to treat multi-walled carbon nanotubes (gelatin-CNTs) for fabricating multifunctional epoxy nanocomposites. The study results show that the gelatin-CNTs are more effective than a type of chemically treated CNTs for improving multifunctional properties of epoxy, in addition to the benefit to the environment by avoiding applying conventional acids for CNT treatment. In specific, gelatin treatment significantly improved dispersion of CNTs, wettability, conductivity and mechanical properties for epoxy, in comparison with that of pristine CNTs/epoxy and amino treated system, NH_2-CNTs/epoxy. The electrical conductivity of the epoxy nanocomposite with 0.5wt% of gelatin-CNTs is two orders of magnitude higher than the NH_2-CNTs/epoxy. The enhancement in the flexural modulus and strength of the 0.5wt% gelatin-CNTs/epoxy is much bigger than those of NH_2-CNTs/epoxy. The mechanism that is responsible for such significant enhancement in multifunctional properties is analyzed. This research work provides a new green avenue to the fabrication of high performance multifunctional nano-modified epoxy matrix.

Keywords: A. carbon nanotube; A. Functional composites; B. Electrical properties; B. Mechanical properties; D. Scanning electron microscopy (SEM)