CNTs/polymer nanocomposites for antifouling activity: surface properties and perspectives

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Abstract

Prevention of marine biofouling is a problem of considerable economic importance because biofouling shortens service life and increases operating costs. Many commercial vessels and warships currently use antifouling coatings that minimize the buildup of marine organisms to ship hulls and submarines. Although effective, these coatings contain organometallic compounds that are potentially toxic to marine environments. They are, therefore, subject to current and future environmental regulations. An alternate to these toxic paints would be an environmentally benign coating from which marine organisms could be easily removed.

A surface that would totally resist biofouling has been sought for many years and continues to attract considerable practical and theoretical interest. Unfortunately, there is not as yet a surface that completely resists biofouling. Ideally, the bioadhesion would be weak enough that the weight of the foulant or the hydrodynamic forces created by the ship's motion would dislodge the marine organisms.

Polymer composites, consisting of additives and polymer matrices, including thermoplastics, thermosets, and elastomers, are considered as an important group of relatively inexpensive materials for many engineering applications.

Epoxy resin (ER) category is one of the most common thermoset polymer categories used in the formation of polymer nanotube composites; these polymers cure when mixed with a crosslinker, a catalyzing agent or hardener. ERs have been widely used in practical applications such as adhesives, construction materials, composites, laminates, and coatings due to their excellent mechanical properties, low cost, ease of processing, good adhesion to many substrates, and good chemical resistance.As a new type of reinforcement, single and multi wall carbon nanotubes (SWCNTs and MWCNTs, respectively) have been widely investigated as their incorporation into appropriate matrixes (metals, ceramics, and polymers) produces composites with improved mechanical performance. CNT/metal composites have been used in several applications, such as fillers in metal-metal joints; however, the main research efforts are focused on CNT/polymer composites. Charitidis et al. studied the

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nanomechanical and nanotribological behavior of polyvinylbutyral/CNT composites with varying filler content and illustrated the dependence of CNT concentration on nanomechanical properties.

The present work reports on the preparation and characterization of protective antifouling coatings for marine applications. Polymer coatings filled with different percentage of multiwall carbon nanotubes (MWCNTs) were prepared. The CNTs were added in order to enhance the properties (surface and mechanical) of polymer. These coatings present advantages in the field of antifouling paints, hence, they are thought as potential candidates in marine paint industry.

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