Polymeric Nanocomposite Coatings for the Corrosion Protection of Steels

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Corrosion is a challenging issue faced by many industries, causing substantial economic losses due to the degradation of materials. According to the National Association of Corrosion Engineers (NACE)'s report, the global cost of corrosion is 2.5 trillion US dollars, equivalent to 3.4% of the US Gross Domestic Product (GDP). Disengaging the corroding metal from the harsh corrosive media through the intact organic coating is one of the most feasible ways of protecting metallic assets. In this research, polymeric smart nanocomposite coatings were developed and evaluated for their corrosion resistance behavior. Environmental friendly and naturally occurring halloysite nanotubes (HNTs) were selected as a reinforcement and were loaded with methyl thiourea (corrosion inhibitor) using vacuum cycling method. Morphological and structural characterization was carried out to confirm successful loading of methyl thiourea in HNTs. The loaded HNTs (5 wt. %) were thoroughly mixed in epoxy matrix and coated on steel substrate using doctor blade technique to develop smart nanocomposite coatings. Later, the developed smart nanocomposite coatings were cured at room temperature for 48 hrs. The corrosion inhibition capability of the smart nanocomposite coatings was evaluated in 3.5 wt.% NaCl solution at room temperature using electrochemical impedance spectroscopy (EIS). The results indicate that smart nanocomposite coatings demonstrate promising corrosion resistance capability. The decent corrosive resistance behavior of smart nanocomposite coatings can be attributed to the efficient release of methyl thiourea from HNTs during the immersion period. The promising corrosion resistance characteristics of smart nanocomposite coatings make them attractive for many industrial applications.