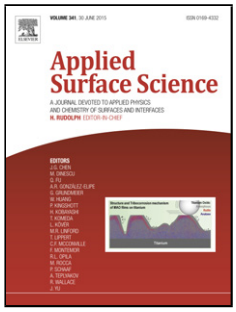

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Degradation of Modified Carbon Black/Epoxy nanocomposite Coatings under Ultraviolet Exposure

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Abstract

Degradation of epoxy coatings with and without Carbon Black (CB) nanoparticles under ultraviolet (UV) radiation were investigated using electrochemical impedance spectroscopy (EIS). Sodium dodecyl sulfate (SDS) was used to obtain a good dispersion of CB nanoparticles in a polymer matrix. TEM analysis proved a uniform dispersion of modified CB nanoparticles in epoxy coating. The coatings were subjected to UV radiation to study the degradation behavior and then immersed in 3.5 wt% NaCl. The results showed that the electrochemical behavior of neat epoxy coating was related to the formation and development of microcracks on the surface. The occurrence of microcracks on the surface of the coatings and consequently the penetration of ionic species reduced by adding CB nanoparticles into the formulation of the coatings. CB nanoparticles decreased degradation of CB coatings by absorbing UV irradiation. The ATR-FTIR results showed that decrease in the intensity of methyl group as main peak in presence of 2.5 wt% CB was lower than neat epoxy. In addition, the reduction in impedance of neat epoxy coating under corrosive environment was larger than CB coatings. The CB coating with 2.5 wt% nanoparticles had the highest impedance to corrosive media after 2000 hrs UV irradiation and 24 hrs immersion in 3.5 wt% NaCl.

Key Words: Epoxy nanocomposite Coatings, UV degradation, Modified Carbon Black, TEM, ATR-FTIR, EIS.

1- Introduction

Epoxy resins have tremendous applications in the polymer field because of their range of attainable properties and versatility [1, 2]. However, due to the presence of aromatic moiety generally they are degraded in the presence of UV light and humidity. Weathering of epoxy resins is fairly good for castings and laminates but for thin films and epoxy paints, it is generally regarded only as fair, because of discoloration and chalking. This is the major cause of concern for the polymer that limits the use of epoxies for outdoor applications. The surfaces of epoxy resin composites are often degraded under conditions that induce chemical and physical changes such