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Aqueous dispersion of polyurethane nanocomposites based on calix[4]arenes modified graphene oxide nanosheets: preparation, characterization, and anti-corrosion properties

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Abstract

Environmental-friendly waterborne polyurethane/graphene oxides nanocomposites (WPU/GOs) were prepared using *p-tert*-butyl calix[4]arene (BC4A) and sodium p-sulfonatocalix[4]arene (SC4A) modified GO nanosheets (CGO and SGO) as novel anti-corrosion coatings. Structural, thermal, and morphological investigation of nanosheets by FTIR, XRD, Raman, XPS, TGA, and SEM analysis confirmed their synthesis successfully. Moreover, different properties of WPU/GOs films were also evaluated by ATR-FTIR, XRD, SEM, contact angle, TGA, DSC and tensile analysis. It was found that the modification of GO nanosheets with BC4A and SC4A macrocycles not only overcome the flocculation and coagulation problem of unmodified GO incorporated WPU dispersion (WPU/GO) but also afford better mechanical properties to nanocomposites. The SEM morphological inspection exhibited that the microphase separation degree and dispersion quality of nanosheets within the nanocomposites strongly depends on the type of incorporated nanosheets. Regarding WPU/CGO and WPU/SGO nanocomposites, CGO and SGO nanosheets provide the enhanced storage stability and dispersibility compared to unmodified GO in WPU/GO sample. Anti-corrosion efficiency of the samples was also evaluated by PDS and EIS techniques and the results revealed that the WPU/CGO sample acts as a highly efficient anti-corrosion coating for mild steel and can be introduced as green corrosion protective coating with inhibition efficiency of 99.8 %.

KEYWORDS: Waterborne polyurethanes; Calix[4]arenes; Graphene Oxide; Surface modification; Anti-corrosion coatings; Mild steel.

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