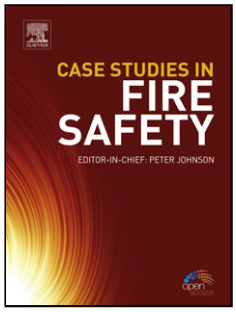

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Graphene oxide–poly(urea–formaldehyde) composites for corrosion protection of mild steel

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Highlights :

- Graphene oxide–poly(urea–formaldehyde) composites with 8.6 wt.% GO sheets exhibited the optimal corrosion protection of mild steel.
- Urea–formaldehyde improved the compatibility of GO sheets with epoxy coating.
- Urea–formaldehyde protected lamellar GO sheets from agglomeration during ball-milling process by sacrificing UF microspheres in size.

Abstract

Graphene oxide–poly(urea–formaldehyde) (GUF) composites were prepared by anchoring a prepolymer of urea–formaldehyde resin onto graphene oxide (GO) sheets through in–situ polycondensation. Five GUF composites with 2.6, 4.3, 8.6, 20.8, and 34.6 wt.% GO sheets were synthesized and added into epoxy resin by ball milling. Results of sedimentation test, transmission electron microscopy, and cross–sectional microstructural analysis showed that GUF/EP coatings with 8.6 wt.% GO sheets were compatible with the polymer matrix. Electrochemical impedance spectra further revealed the optimal corrosion protection of GUF composites with 8.6 wt.% GO sheets.

Keywords: Graphene oxide; Urea–formaldehyde resin; Epoxy coating; Barrier performance; Corrosion protection

1. Introduction

Epoxy resin coatings are widely used because of their versatility, intrinsic toughness, electrical resistance, durability at high and low temperature, and good adhesion on various substrates [1, 2].

However, the corrosion protection of neat epoxy coating is limited by the formation of corrosion channels because of solvent evaporation and hydrolytic degradation after exposure to corrosive electrolytes [3].

The barrier and corrosion protection of epoxy coatings have been improved using