Corrosion Protection Coatings from Size-Specified Graphene Oxide

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Abstract. Corrosion performance of graphene oxide (GO) coatings from different sheets sizes in 3.5 wt% NaCl solution was investigated. The GO dispersion was subjected to 5 and 10 hours of ultrasonication before electrophoretically deposited (EPD) onto the copper substrate. It was found that the EPD-GO coating from smaller sheets (10h ultrasonication) possess hydrophobic, thinner film and smooth surfaces. It is suggested that the corrosion performance of the coating from smaller GO sheets is improved due to the surface texture and compactness of the coating as compared to the larger GO sheets.

Introduction

The potential of graphene as anti-corrosion coating is undeniable. Several researchers have reported the remarkable findings of graphene in inhibiting the corrosive species that promote corrosion [1, 2]. They provide an unexceptional impassable property that is attributed to their outstanding features such as chemical inertness [3] as well as excellent impermeability to liquid and gasses [4]. Its natural diffusion barrier is expected from the sp^2 carbon allotropes that allow a physical separation between the underlying metal surfaces and corrosive electrolytes, which potentially become the thinnest possible anti-corrosion layer[5].

Recently, one of the essential graphene derivatives that are graphene oxide (GO) has received much attention as a platform for anti-corrosive coating [6, 7]. Similar to graphene, GO also demonstrates excellent thermal and chemical stability [8]. The additional advantage is somehow due to its amphiphilic structure, which consists of a hydrophobic, *p*-conjugated 2D carbon sheet that contains various hydrophilic oxygen functional groups [8]. Its hydrophilic nature facilitates uniform dispersibility in water, thereby beneficial for coating deposition from water-based electrolyte baths such as electrophoretic deposition (EPD).

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