

Application of Magnesium-Manganese Phosphate Coating on Low Carbon Steel

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Abstract

A novel magnesium-manganese phosphate coating was applied on low carbon steel from a phosphate solution at different temperatures. The composition and surface morphology of the coatings were characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM) methods. Potentiodynamic polarization curves were used to examine the corrosion resistance of the coating. It was observed that the coating consists of Newberyite, Hureaulite and manganese hydrogen phosphate hydrate. The experimental results indicated that the coating had fine crystals forming a dense coating at 90 °C. As a result, improvement of the corrosion resistance of the low carbon steel by the phosphate conversion treatment was achieved.

Keywords: Conversion coating, Magnesium-Manganese Phosphate, Corrosion.

1. Introduction

Carbon steels are widely used in various industries, due to their high strength, good hardness and proper toughness, but their low corrosion resistance limits their application in some cases. Attempts have been carried out to overcome this problem utilizing applicable methods[1]. Phosphating is a conversion process widely used in industries like automotive industries because of its comparatively cheap and easy operation and is a well-known method for surface treatment of steel before painting for corrosion protection and anti-wear[2,3]. Phosphate conversion coatings are applied to a wide range of substrates including carbon steel, galvanized steel, magnesium, aluminum, zinc and even stainless steels to improve their paintability[4–6]. Conventional phosphate coatings are zinc, manganese and iron phosphates. Lots of research has been done to improve corrosion resistance in phosphate coatings. Using double cationic phosphate coatings, such as zinc-manganese and zinc calcium have shown to be effective for improving the corrosion resistance and thickness of these coatings[7–9]. Magnesium phosphate coating, recently studied as a novel kind of chemical conversion coating, has been successfully applied carbon steels and magnesium alloys[10–12]. It was shown that magnesium phosphate coatings are about 3 times thicker and possess better corrosion resistance compared to

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