LOCALISED CORROSION MECHANISM STUDIES IN ZINC ALUMINIUM ALLOY GALVANISED STEELS RESOLVED USING THE SCANNING VIBRATING ELECTRODE TECHNIQUE

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ABSTRACT

Zinc-aluminium alloy galvanised steel is increasingly used uncoated, as a roofing product and as an organically coated substrate (OCS) for structural cladding applications, since it has superior anti-corrosion performance to traditional galvanised steel. It has been shown that additions of magnesium can improve the surface corrosion resistance of the metallic alloy coating.

The scanning vibrating electrode technique (SVET) has been used to study the effect of variation in magnesium levels (0.01-0.05%) on corrosion mechanisms on experimental samples prepared on 0.7 mm gauge steel substrates with a hot dip bath composition of near eutectic 4.2% aluminium / *ca.* 95.8% zinc. The mechanism of corrosion, in 5% aerated aqueous sodium chloride electrolyte, on the surface of zinc aluminium alloy galvanised steels prior to organic coating and on the exposed cut edges following application of 200 μm PVC based coating and 15 μm polyester coating to either side has been found to be markedly different.

The SVET data has shown that increasing the magnesium levels decreases the intensity and localisation of surface corrosive attack in the absence of organic over layers. This decrease in surface corrosion is directly related to the surface microstructure of the samples. The SVET data has shown that the surface corrosion is initiated at the edges of eutectic nodules where zinc rich phases and impurities tend to be preferentially deposited. In samples with low magnesium levels there are small cracks at these locations, which are absent in the higher magnesium level samples. In this instance the improvement in surface quality at higher magnesium levels renders the samples more stable towards corrosive attack.

The cut edge corrosion mechanism of organically coated zinc aluminium alloy samples is very different to that for the bare alloy surface. The SVET data obtained in these instances has shown that there is an increasingly intense and localised attack as the magnesium levels are increased. Again, this can be related to the coating microstructure. Microscopic investigation yields high concentrations of pro-eutectic zinc rich sub surface phases, which are revealed on cutting through the galvanised substrate and exposing a cut edge, in high magnesium samples. This highly heterogeneous coating metallurgy at the highest magnesium levels used is seen to become a dominant factor determining the corrosion mechanism overriding the effects of the organic over-layers.

Keywords: Scanning Vibrating Electrode Technique, Corrosion, Zinc Aluminium Alloy Coatings.