5TH REGIONAL SYMPOSIUM ON ELECTROCHEMISTRY SOUTH EAST EUROPE

PROGRAM

BOOK OF ABSTRACTS

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Corrosion Stability of Cerium Modified Cataphoretic Epoxy Coatings on Al6060 Alloy

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Protective coatings should provide good barrier to ingress of corrosive species, sufficient adhesion to the substrate as well as good compatibility with additional top coats. The presence of pigments and/or functional agents in the coating composition could be beneficial [1,2] in the corrosion protection.

The doping with rare earth elements, like cerium, has shown to enhance the corrosion stability of organic coatings due to their self-healing properties [3]. In this work cerium doped nanometric epoxy primers were deposited cataphoretically with different amounts of cerium nitrate (1, 5 and 10 mM) with the aim of optimizing the cerium content in the epoxy emulsion with respect to adhesion and corrosion stability of deposited primer coating. Cerium-free epoxy coating was also analyzed as a reference. The long term protection was evaluated in the chloride environment (3 wt.%NaCl) using electrochemical impedance spectroscopy (EIS) and polarization measurements. Coatings were also analyzed by scanning electron microscopy (SEM) coupled with EDX, Fourier transform infrared spectroscopy and thermogravimetric measurements. Size and zeta potential of epoxy emulsion were measured by dynamic light scattering and Laser Doppler velocimetry. Adhesion was determined both by a standardized pull-off method and by swelling in *N*-methyl pyrrolidone [4].

The ceria content, as well as its distribution in the epoxy coating, was determined by SEM cross-sectional analysis. The homogeneity of epoxy coatings was evaluated and related to corrosion stability. The results showed that cerium-doping can promote the formation of compact epoxy coatings with enhanced protectiveness in the early stage of immersion in the corrosive media. Increased barrier properties of epoxy primers suggest good compatibility of ceria particles with polymeric epoxy layer. However, zeta potential measurements indicated that higher amounts than 10 mM $Ce(NO_3)_3$ added into the epoxy emulsion resulted in unstable emulsion. The water content in the epoxy coatings and their thermal stability were also determined. In addition, a detailed EIS study was undertaken to follow the evolution of corrosion stability of all samples with time of exposure to corrosive media.

It was shown that all examined ceria containing epoxy emulsions resulted with the enhanced adhesion and corrosion stability of epoxy primers. However, the smallest loading of 1 mM showed only improvement during the initial exposure to NaCl solution. EIS and polarization measurements confirmed that higher ceria loadings also provide long term protection in chloride solution.The optimal ceria content in the epoxy emulsion, with respect to adhesion strength, thermal stability and long-term corrosion stability of protective systems was 10 mM.

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