

## **EIS study of hybrid sol-gel coatings on aluminium**

I. Rute Fontinha<sup>a,\*</sup>, M. Manuela Salta<sup>a</sup>, M. Zheludkevich<sup>b</sup> and M.G.S Ferreira<sup>b,c</sup>

<sup>a</sup>*Laboratório Nacional de Engenharia Civil, Av. Brasil, 101, 1700-066 Lisboa, Portugal*

<sup>b</sup>*University of Aveiro, CICECO, Department of Ceramics and Glass Engineering,  
3810-193 Aveiro, Portugal*

<sup>c</sup>*Instituto Superior Técnico, ICEMS, DEQB, 1049-001 Lisboa, Portugal*

The organic-inorganic hybrid sol-gel films have been reported as an effective anti-corrosion pre-treatment for aluminium alloys. The sol-gel process used to obtain these coatings allows variation of the different synthesis parameters to achieve coatings with optimized properties. In this work, hybrid films were synthesized from glycidoxypropyltrimethoxysilane (GPTMS) and zirconium *n*-propoxide (TPOZ) precursors, using different water ratios for the hydrolysis of GPTMS ( $W_{\text{GPTMS}}=0,5$  to 4) and applied to EN AW-6060 alloy by dip-coating. The corrosion behaviour of aluminium specimens coated with these films was evaluated by Electrochemical Impedance Spectroscopy (EIS) in 0.5 M NaCl solution for 35 days. The results obtained revealed that the hybrid films provided effective corrosion protection, exhibiting good barrier properties (with an optimum for  $W_{\text{GPTMS}}=2$ ) and some self-healing ability. The hybrid films prepared were also characterized by Energy Dispersive Spectroscopy (EDS), Scanning Electron Microscopy (SEM) and Infrared Spectroscopy in order to relate their morphology and chemical structure with the corrosion behaviour.

**Keywords:** Hybrid coating, sol-gel, EIS, corrosion.

\*corresponding author; Tel. 218443633, Fax 218443023, [rfontinha@lnec.pt](mailto:rfontinha@lnec.pt)