



## OO/UC3M/44- NANOPARTICULATE SOL-GEL PRETREATMENTS AS BARRIER COATINGS AND ADHESION PROMOTERS FOR METALLIC CORROSION PROTECTION

The Spanish university Carlos III de Madrid has developed sol-gel coatings for the corrosion protection of alloys. Sol-gel coatings represent a physical barrier between the metallic substrate and the aggressive environment of exposition and act as adhesion promoters through interfacial bonding. Optimization of the coating's properties may be easily achieved by changing the processing parameters and formulation of the layer.

Interest in licensing the applied patent or technical cooperation with companies that would like to incorporate this technology.

### Description and special features

The sol-gel polymeric coating network is obtained through hydrolysis, by additions of water, of a mixture of silanes, while in-situ oxide nanoparticles are created from metal alcoxides precursors. The solution of hidrolized compounds is deposited on the metallic substrates by the dip immersion process at a control withdraw rate. Polymerization takes place under heating at low temperatures (around 100°C) leading to a dense and continuous network with embedded oxide nanoparticles. Sol-gel coating is bonded to the metallic surface through strong covalent bondings of the type Metal-O-Si and may be also easily bonded to superficial organic paint layers through reaction between functionalized groups. Oxide nanoparticles enhance sol-gel coatings properties as barrier properties (for the metal corrosion protection), adhesion, mechanical behavior and thermal stability. And furthermore, oxide nanoparticles confer new characteristics to the polymeric network upon the selected oxide such as optical properties.

### Innovative aspects

Metallic oxide coatings have been used for the protection of a great variety of alloys. However, the high temperatures used in their synthesis (around 500°C) lead to the formation of cracks which are detrimental for the coatings properties and resistance. The introduction of oxide nanoparticles in polymeric sol-gel networks allows obtaining dense and crack-free coatings with enhanced properties such as barrier properties for corrosion protection, mechanical behavior and thermal stability.

### Competitive advantages

Chromate conversion coatings have been extensively used in the aircraft industry for the corrosion protection of structural aluminium parts. However, its uses are restricted due to the hazardous effects of Cr (VI) on water foils and human health. In this sense, sol-gel coatings have emerged as potential candidates for their replacement due to their healthy and environmentally friendly nature. Moreover, the control of the processing parameters allows the reproducibility of the results.

### Technology Keywords

Coatings; Materials properties; corrosion/degradation;

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