**ACTIVE AND PASSIVE CORROSION PROTECTION OF AA2024-T3 BY AN HYBRID INHIBITOR DOPED MESOPOROUS SOL-GEL AND TOP COATING SYSTEM**

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The aerospace industry increasingly requires a new generation of environmentally-friendly coating systems for 2024 aluminum alloys (AA2024). Especially when taking into consideration the ban of carcinogenic Cr(VI) as from 2017. Those coatings should be designed to offer both passive (barrier) protection for intact coatings and active protection to the metal when coating defects are present.

In this work, the system is composed of two layers, each playing a unique role in the overall protection scheme: a reservoir and release functionality for corrosion inhibitors (active or self-healing protection) as well as barrier protection against an aggressive environment (passive protection). The first layer is a mesoporous sol-gel thin film (~250 nm) doped with benzotriazole molecules and synthesized through an evaporation induced self-assembly (EISA) process. The passive functionality of this pretreatment was voluntarily given up by generating a porosity inside the film aiming at incorporating a high quantity of corrosion inhibitors and focusing on the active functionality. The second layer is an organic top coat based on an acrylic copolymer (2-ethylhexyl acrylate (EHA)-*co*-glycidyl methacrylate (GMA)). This organic coating (~1 µm) prevents the diffusion of aggressive species to the metallic surface and confine benzotriazole molecules inside the mesoporosity except at flawed places where corrosion processes appear.

In order to evaluate the barrier performance of the coating system, the electrochemical response of unscratched samples was studied as function of the immersion time in sodium chloride solution using electrochemical impedance spectroscopy (EIS). Coatings were also mechanically scratched in order to stimulate the corrosion degradation of the aluminum surface. Scanning vibrating electrode technique (SVET) and scanning electrochemical microscope (SECM) were used to monitor corrosion processes over the scratched sample surface. In addition, electrochemical micro-cell measurements were performed inside the scratch after different exposure times in the aggressive solution to highlight the formation of a passive film.

The presence of an inhibitive layer due to the release of benzotriazole from the mesoporous silica pretreatment demonstrates the potential of those coatings to offer active protection to AA2024-T3 aluminum alloys. Inhibitive species added in the first layer help to reinforce the barrier layer of the top coat in case of scratches or damages by forming a local protective film on the exposed metal which slows down the initial stage of corrosion phenomena.