**Combination of epoxy coating with cerium-modified clays doped hybrid sol-gel film for active corrosion protection of aluminium alloys**

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Aluminum alloy 2024 (AA2024) is widely used as an important material for aerospace industry. Therefore, with high copper content, AA2024 is susceptible to corrosion, especially pitting or intergranular corrosion. Generally, the pre-treatments exploiting the Cr (VI) compounds have been considered as the most effective conversion layers for protection against corrosion of this alloy due to the strong oxidation properties of Cr (VI). Unfortunately, as they cause problems on human health and the environment, new pre-treatments for corrosion protection have been actively developed in the last decade. This work presents a new approach to develop protective multilayer system of aluminum alloys AA2024 based on the inhibitor efficiency of cerium ions which are considered as a promising alternative to replace chromate compounds.

Cerium ions were inserted into nanoclays platelets by cationic-exchange reactions (CeMMT). XRD analysis proved the presence of cerium ions intercalated into clays structure. EIS measurements and polarization curves highlighted a high corrosion inhibition effect of cerium-modified nanoclays. This effeciency can be related to the release of 60 % of cerium ions from CeMMT structure in sodium chloride solution as determined by UV-VIS measurements. EIS measurements revealed that hybrid sol-gel film doped with CeMMT improved barrier properties and anticorrosion protection of aluminum 2024 substrate. Scanning Vibrating Electrode Technique and salt spray test made on scratched sol-gel samples indicated a self-healing effect of cerium ions which provide an active corrosion protection to aluminum substrate. A second layer based on solvent-free epoxy coating was then applied onto hybrid sol-gel film. When combining cerium-nanocontainers doped sol-gel film with epoxy coating, EIS measurements showed a high potential anticorrosion property of this multilayer system to protect aluminum 2024.

Results of this research indicated that epoxy coating combining sol-gel film incorporating cerium-nanocontainers can give an active corrosion protection to AA2024.

**Keyword**: Sol-gel, AA2024, corrosion, montmorillonite, cerium salts, EIS, epoxy

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