International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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Self-Healing, Corrosion Protection Coatings on Al and Mg Alloys

Overview

Chromate conversion coatings have been the most widely used anti-corrosion treatments for Al/Mg alloys. However, there is an increasing demand for the development of environmentally friendly and cost-effective self-healing coatings for corrosion protection, due to the toxicity of hexavalent chromium. Self-healing is the phenomenon of repair or recovery of a material from a damage by itself without the use of any external stimulus. Self-healing coatings can be based on either polymerization mechanism or through corrosion inhibitors, where the monomers/catalyst or corrosion inhibitors are encapsulated into smart micro/nanocontainers and added to the coating formulation. The monomers/catalysts/corrosion inhibitors are released only on demand, i.e., when there is a damage in the coating leading to exposure of the underlying metal substrate to the corrosive medium, thereby prolonging corrosion protection. Self-healing coatings developed at ARCI are based on cost-effective and eco-friendly nanocontainers for encapsulation of corrosion inhibitors, and are used in conjunction with a hybrid sol-gel matrix.

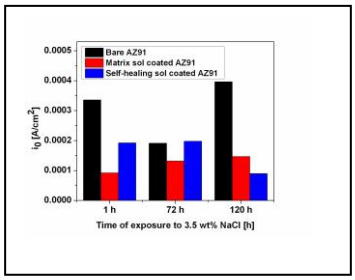
Key Features

- Non-toxic and eco-friendly
- Amenable to coat large areas with easy automation
- Good adhesion to the substrate materials
- Can be applied as bond coat to promote adhesion of primers
- Can be made as Decorative coatings also
- Low temperature (≤130°C) curable

Photographs of coated and bare AA2024-T4 substrates after 168 hrs of salt spray test

Potential Applications

- Aircraft bodies
- Automotive components
- Any Al/Mg alloy component
- Can be used as an additive in paints/primers to enhance corrosion protection



Comparison of corrosion currents for bare and coated AZ91 substrates

Intellectual Property Development Indices (IPDI)

- Performance and stability are validated on coupons at laboratory scale

Status	1	2	3	4	5	6	7	8	9	10

Major Patents / Publications

1. An improved coating composition to provide prolonged corrosion protection to anodizable metal surfaces and process of preparing the same Indian Patent Application number 3082/DEL/2015 dtd 28-09-15.
2. An improved composition for coating anodizing metal surfaces and a process of coating the same. Indian Patent Application number: 1310/DEL/2013 dtd 03-05-13.
3. N. Kumar, A. Jyothirmayi, K. R. C. Soma Raju, V. Uma and R. Subasri (2013): One Step Anodization/Sol-Gel deposition of Ce^{3+}-doped silica-zirconia Self- Healing Coating on Aluminum, ISRN Corrosion, article id 424805

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