

Smart Self-healing Eco-friendly Nano and Nano-composite Protective Coatings

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Abstract – This paper reports our achievements in designing high performance eco-friendly coatings technologies for light-weight materials through international collaborations with USA, Italy, France, Romania, UK and Germany

Aluminum and its alloys are used widely in aerospace, automotive and packaging applications. The demand for weight savings for automotive and aerospace materials has focused attention on magnesium alloys. Several automobile manufacturers (Ford, GM, Chrysler, Volkswagen, Opel, FIAT) have co-operated to develop new magnesium alloys for manufacturing less energy-consuming and hence, less polluted automobiles. Because of its growing use in the transportation industry, the world demand and production of magnesium have been growing steadily. Magnesium alloys have a variety of excellent properties. However, Mg alloys remain very susceptible to corrosion despite their superior mechanical properties.

Chromate has been reported as the most efficient widespread conversion coatings for many metallic substrates. However, the waste containing hexavalent chromate has many limitations due to the environmental consideration and health hazards.

The aim of this article is to deepen the current understanding of corrosion and protection of aluminum and magnesium and their alloys and to provide a base for future research work in this field. It will also report the recent development in designing eco-friendly conversion coatings based on cerate, stannate, zirconate, vanadate or molybdate conversion coatings as alternatives to the process involving toxic chromate.

Index Terms – Aerospace and automotive industry, chrome-free coatings, corrosion protection, surface treatments.