Development of functionalized coating by sol-gel process on aluminium alloy

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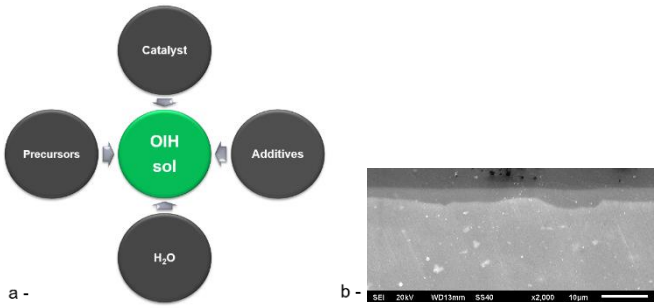
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Abstract

The goal of this study is to develop an innovative coating in accordance with the environmental regulations REACH and RoHS.
Innovation will consist in an original approach of the sol-gel process implementation. Compared to the current platings, environmentally unfriendly processes due to hazardous chemicals to health and environment, this innovative liquid process is very interesting to work on many different substrates. The formulation is designed according to the required properties of the coating, throughout an appropriate surface structuration.
The originality of the approach is to develop a formulation with an adequate choice of precursors and fillers which bring simultaneously anticorrosion and electrical conductivity.
The literature provides many sol-gel formulations, and the most suitable for complex shape parts are composed of both organic and inorganic precursors. They are named Organic Inorganic Hybrid (OIH) sol-gel coating[1]. Coating flexibility and anticorrosion properties are some of the properties provided by an OIH coating.
In our study, organic and inorganic precursors are selected towards anticorrosion properties. Inhibitor is also added to sol-gel matrix[2] to improve the corrosion resistance.
Some works have been performed on the influence of different fillers on the electrical properties of the polymer matrix[3], but the innovative study here is to combine the anticorrosion and electrical properties in a coating prepared by sol-gel route. To bring electrical properties to sol-gel coating, different fillers are taking on and studied. Influence of fillers natures, form factors and quantities are evaluated to find an optimum composition. Electrical, viscosity and hydrophobic characterization are accomplished to file fillers in function of their behavior in the sol-gel matrix.
Structural and microstructural characterizations are performed by 3D optical microscopy and scanning electron microscopy. The chemical interaction between the sol-gel coating and the substrate is also deeply characterized and specially the durability of materials under corrosive conditions by coupling salt spray test, electrochemical impedance spectroscopy, nano scratch and nano indentation.

Image



a - OIH sol composition and b – SEM micrography of OIH coatings on aluminium alloy substrate

References

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Biography

Clément Genet is a Ph.D. Student at Université de Toulouse Paul Sabatier and research associate at CIRIMAT laboratory and Amphenol Socapex company. He has obtained his Engineer's degree in Materials Science at ESIR (Rennes-France) and he has a specialization with his Master's degree in Materials Science for Aeronautics and Aerospace at Université de Toulouse (Toulouse-France). He has experience in the synthesis and characterization of nanostructured materials and coating for more particularly anticorrosion properties in aeronautic field.

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