

Monday Evening, December 9, 2024

Thin Films and Surface Modification

Room Naupaka Salon 4 - Session TF1-MoE

Thin Films - Materials I

Moderator: Ryo Toyoshima, The University of Tokyo

6:20pm **TF1-MoE-3 Plasma Diagnostic-Based Plasma Processing for Semiconductor and Nanomaterial Manufacturing**, *Hyo-Chang Lee*, Korea Aerospace University, Republic of Korea **INVITED**

Plasma has been actively used in semiconductor and nanomaterial manufacturing. As the structures of nanostructures and semiconductor devices become more complex, plasma process technology based on plasma characteristic measurement is needed. In this invited talk, several key plasma process results, including analysis of the correlations between process results and plasma variables, are presented.

7:00pm **TF1-MoE-5 Tailoring High Temperature Anti-Oxidizing Coatings by Sol-Gel Chemistry for Enhanced Aeronautic Efficiency**, *Louis-Jean Lager*, University Lyon 1, France; *Sophie Senani-De Monredon*, *Jerome Delfosse*, Safran Tech, France; *Stephane Benayoun*, Ecole Centrale de Lyon, France; *Berangere Toury*, University Lyon 1, France

Reducing polluting gases emissions is a major strategic challenge for the aeronautic industry. Two approaches exist to achieve this : increasing engine operating temperatures and/or reducing the total mass of the aircraft. Titanium alloys, due to their low density, good damage tolerance, and excellent fatigue resistance, are particularly attractive for use up to temperatures of 500°C.

To date, the scientific challenge concerning these alloys is to extend their operating temperature resistance up to 600-700°C while maintaining or improving their specific properties required for the aimed application. One of the main causes of degradation in these alloys when used at high temperatures is related to oxidation. Actually, for these materials, oxidation can occur in two distinct ways : firstly, the formation of an external oxide layer (TiO₂), and secondly, significant oxygen diffusion within the underlying alloy. This second phenomenon is linked to the high solubility of oxygen in titanium. In both cases, without additional protection, the use of titanium alloys at high temperatures considerably reduces their mechanical properties, especially ductility.

In this context, the main goal of this study is focused on the design, synthesis and characterization of a high temperatures anti-oxidizing coating based on rare earth aluminate for enhanced titanium alloys used in aeronautics. In this work, we are interested in the synthesis of protective coatings by using the sol gel process, which is a versatile method allowing direct enduction of the sol on metallic substrates. Thus, leveraging precise control over sol chemistry enables the reach of coatings with desired stoichiometry. The morphology of the coatings is meticulously examined via SEM. Additional characterizations utilizing XPS, solid NMR, and thermal analyses where used to understand curing mechanisms. Initial oxidation tests reveal promising prospects for the application of these coatings in aeronautic contexts, potentially enhancing engine efficiency while mitigating environmental impact.

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