Thin Films and Surface Modification
Room Naupaka Salon 4 - Session TF2-ThM

Thin Films - Surface Modifications
Moderator: Hyo-Chang Lee, Korea Aerospace University

10:20am **TF2-ThM-8 Design at Nanoscale of Thermostable Hybrid Sol-Gel Bondlayer to Functionalize Aeronautical CFRP by Thermal Spray*, Sophie Senani-de Monredon,*** SAFRAN TECH, France*; L. Rozes,* Sorbonne Université, France*; G. Penvern,* SAFRAN TECH, Sorbonne Univ., France*; A. Joulia,* SAFRAN TECH, France*; S. Bonebeau,* SAFIR, France

Composite Fibers Reinforced Parts (CFRP) are widely used in aeronautic since more than 40 years to contribute to decrease the aircrafts environmental footprint. Indeed CO_2 and NOx emissions have been considerably decreased by lightweighting correlated to significate fuel consumption reduction (15% for last LEAP aircraft engines). Nevertheless to go further and reach the new ambitious target of 20% reduction for the next aircraft engine, functionalization and metallization of CFRP is mandatory to extend them to more aggressive use cases than fuselage, by resistance against high temperature, erosion or icing. To reach this goal, thermal spray coatings are widely studied, even if it remains very complex to implement.

Metallization of CFRP, especially by coldspray is favored by numerous teams [1,2,3], with interesting results but not sufficient to fit performance required for aeronautic qualification. Our approach aims to design a thermostable sol-gel hybrid bondcoat. We will discuss how we succeed to control of the chemical composition, the nanostructuration of this bondlayer and the nature of the substrate/bondlayer/topcoat interfaces to influence the thermomechanical bondcoat's properties and thus the building and the thickness increase of the thermal sprayed topcoat layer linked to the adhesion of the stack. Understanding the relation between nanostructuration of the hybrid sol-gel layer and their mechanical and thermal properties is essential to optimize the whole system. Finally, this will widely open the variety of materials (from metals to oxydes) reachable to functionalize CFRP part and allow new use cases unthinkable up to now.

References

1- Cold spray of metal-polymer composite coatings onto carbon fiber-reinforced polymer (CFRP). V. Bortolussi, F. Borit, A. Chesnaud, M. Jeandin, M. Faessel, *et al*. International Thermal Spray Conference 2016 (ITSC 2016)., DVS, May 2016, Shanghai, China. p.7 - hal-01337696

2-Metallization of polymers by cold spraying with low melting point powders [https://scholar.google.com/scholar?oi=bibs&cluster=18020247034159663012&btnI=1&hl=fr]. H Che, AC Liberati, X Chu, M Chen, A Nobari, P. Vo, S. Yue, Surface and Coatings Technology, 2021, 418, p 127229

3- CO3 Project– F. Delloro et al (https://www.projectco3.eu/fr/)

10:40am **TF2-ThM-9 Sustainable Artificial Leather Production - Use of Alternative Textile Structures and Modification of Surfaces*, Roxana Ley,*** Institut fuer Textiltechnik der RWTH Aachen, Germany

Previous artificial leather manufacturing processes were mainly based on the use of polyvinyl chloride (PVC) or polyurethane (PU). These materials are applied in several layers to a carrier material and then bonded together. In most cases, the carrier material is a nonwoven. The resulting composite structures are often difficult to recycle due to the difficulty of separating the different layers of material and are therefore increasingly leading to a growing environmental problem.

USING TEXTILE KNOW-HOW TO MAKE THE ARTIFICIAL LEATHER MANUFACTURING PROCESS SUSTAINABLE

Integrating textile expertise into artificial leather production promotes sustainability. Innovative textile structures like weft knitted, warp knitted, and woven fabrics can reduce environmental impact and improve product quality. Spacer textiles, a special form of these structures, allow precise adjustment of distances between cover surfaces and targeted surface treatments. The advantages and disadvantages of these three textile structures as base products for artificial leather are discussed below.

Weft knitting

Weft knitting involves creating loop structures by passing the working yarn through existing stitches. Spacer knits consist of two cover surfaces connected by pile threads, allowing flexible and quick customization during prototyping. However, weft knitted materials may have higher stretchability, potentially causing instability.

Warp knitting

Warp knitting produces closely intertwined loops using multiple needles. Spacer warp knitted fabrics, created on double raschel machines, feature two cover surfaces connected by pile threads. This method offers improved dimensional stability but involves a complex manufacturing process.

Weaving

Weaving creates fabric by crossing warp and weft threads. Double weave fabrics, formed by joining two basic fabrics with pile threads, offer high strength and stability. However, they may be less adaptable to complex shapes compared to knitted structures.

Surface Treatment

Surface treatments such as roughening, embossing, polishing, and coating can enhance the look and feel of artificial leather. These methods can replicate authentic leather textures or impart other properties like softness, grip, or shine. Employing surface treatments allows for the production of sustainable, high-quality faux leather products, promoting a circular economy and recycling by using mono-materials.

11:00am **TF2-ThM-10 Invited Paper*, Sangmin An,*** Jeonbuk National University, Republic of Korea **INVITED**

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