Topical Symposia
Room Town & Country A - Session TS5-MoM

Sustainable Surface Solutions, Materials,Processes and Applications

Moderators: Jyh-Wei Lee, Ming Chi University of Technology, Taiwan , **Noora Manninen**, Oerlikon Balzers, Oerlikon Surface Solutions AG, Liechtenstein

10:00am **TS5-MoM-1 Innovative Processes for High Performance Materials for Low Carbon Energy in a Circular Economy Approach**, ***Frederic Schuster (frederic.schuster@cea.fr)***, CEA, France **INVITED**

Innovative materials and coatings in particular are at the core of innovation process for energy transition. They are not the sole technological challenges but they are often the link that makes progress happen or not, sustainability possible or not, economically feasible or not, ecologically meaningful or not. Metallurgical coatings and thin films have been developped in the field of low carbon energy since a long time ago. This surface functionalization, more and more integrated from the beginning in the steps of design of efficient architectures having to work in environments sometimes harsh and often complex, is the result of the implementation of surface treatment processes sometimes quite old, sometimes revisited, sometimes much more emerging. In a Green Deal approach, sustainability and in particular durability, are the main drivers for the development of surface engineering in energy field. The coatings must often operate under combined stresses such as: mechanical and corrosion, oxidation and irradiation, corrosion and irradiation. In general, the design of a coating must be done on the basis of precise specifications and the choice of the method of elaboration must be made taking into account a certain number of scientific, technological, economical and environmental criteria. Material efficiency, especially when it comes to using for example critical metals as well as the recyclability of scarce resources can also in some cases become one of the criterion of choice. Hybridation of processes is also a strong driver for breakthrough innovation. Surface engineering has made many advances in the past two decades, making possible applications that were not in the past. This is particularly the case with developments for the nuclear energy sector. In the PVD field, the development of ionized PVD such Hipims technology is now very close to the production of protective coatings for EATF (Enhanced Accident Tolerant Fuels) but is also under development in the field of nuclear fuel reprocessing. This very generic technology is also developped in renewable sector, for example for hydrogen production through electrolysis. In the field of CVD, the great diversity of organometallic chemistry offers real opportunities for the development of DLI-MOCVD or Atomic Layer Deposition, and recent advances concerning the upscaling of technology will be presented as well as the great versatility of the process.As for other development of Materials Science and Engineering, surface engineering benefits greatly from digital technologies progresses, in particular Artificial Intelligence, that makes the optimization of complex processes faster.

10:40am **TS5-MoM-3 Pathways for Sustainable Surface Solutions**, *J. Vetter, J. Becker, C. Scholz,* Oerlikon Balzers Coating Germany GmbH, Germany*; F. Rovere,* Oerlikon Balzers, Oerlikon Surface Solutions AG, Liechtenstein*; A. Barth,* Oerlikon Metco AG, Switzerland*; M. Esselbach,* ***Noora Manninen (Noora.Manninen@oerlikon.com)***, Oerlikon Balzers, Oerlikon Surface Solutions AG, Liechtenstein

Surface solutions are enablers of an ecological transformation of production and consumption. The goal is to reach sustainability for instance by product enhancement, efficient materials management, waste reduction, pollution prevention, or energy saving in different applications fields.

Sustainable Surface Solutions are now mostly applied for wear and/or friction reduction, e.g. for tools and automotive components. There are also various deposition or treatment processes which enable different pathways for sustainable solutions for energy conversion and storage. Examples can be found in the field of energy conversion like wind power, fuel cells, electrolyzers, batteries, or supercapacitors. The applications include also thermal insulation, self-cleaning surfaces (e.g. photocatalytic effect, lotus effect), coatings on plastics, optical coatings, medical coatings, decorative coatings, antifouling coatings, corrosion protection coatings, sensoric and electronic coatings.

Also aspects of life cycle assessment "cradle to grave" are of interest for surface solutions beginning with the material selection and ending with the "recycling" (circular economy, cradle to cradle). This analysis has to be intensified besides the pure cost calculations.

The potential and typical dedicated applications of coating solutions based on Oerlikon coating technologies, e.g. for general engineering, emission reduction of cars, including EV and Hydrogen-ICE, and green manufacturing are presented.

11:00am **TS5-MoM-4 Selection of Laser Processing Parameters for Cleaning of Aluminum and FRP Sheets**, ***Bartłomiej Przybyszewski (Bartlomiej.Przybyszewski.dokt@pw.edu.pl)***, *R. Kozera, A. Boczkowska, D. Kuczyńska, H. Garbacz, J. Pura,* Warsaw University of Technology, Poland

This study presents the laser cleaning of grade aluminium alloy sheets as well as Glass Fibre Reinforced Plastics (GFRP) covered with standard paint systems as an alternative for commonly used mechano-chemical stripping methods. A SPI20W laser with wavelength of 1064 nm was applied to remove a variety of painting systems from 2024-T3 alloy sheets with a pure aluminium-clad layer or from composite materials. The paint removing effect from substrates at a laser speed of 500–4000 mm/s, distance of passes of 40-80 µm and different number of passes was studied. Based on detailed substrate examination the best speed for paint stripping was 1000 mm/s with beam distance 40 µm and number of passes strongly depending on the structure of the coating system. The results showed that interaction of laser beam does not cause any significant changes in microstructure or mechanical properties of aluminium alloy, pure aluminium clad or GFRP matrix.

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