Surface Engineering - Applied Research and Industrial Applications
Room Town & Country C - Session G4-WeM

Hybrid Systems, Processes and Coatings
Moderators: Hana Barankova, Uppsala University, Sweden, **Sang-Yul Lee**, Korea Aerospace University, Republic of Korea

11:00am **G4-WeM-10 Water-Repellent and Low Emissivity Coatings on Fabric Prepared by Roll-to-Roll Hollow Cathode PECVD and Magnetron Sputtering***, J. Jolibois,* AGC Interpane Demonstration Center, Germany*; G. Arnoult,* AGC Plasma Technology Solutions, Belgium*; N. Koyra,* AGC Interpane Demonstration Center, Germany*; **John Chambers,*** AGC Plasma Technology Solutions, USA*; H. Weis,* AGC Interpane Demonstration Center, Germany*; H. Wiame,* AGC Plasma Technology Solutions, Belgium

Thin film deposition appears to be a suitable process for textile finishing at a time when environmental protection is a global concern. It enables textile functionalization without the wet processing drawbacks, such as hazardous wastewaters. Moreover, thin film technology limits the use of chemicals, water, etc., and do not require a drying system resulting in low energy consumption. Water and oil repellent finishes by PECVD are among the most studied treatments for fabrics. While recently there is a growing interest in metallizing textiles using the magnetron sputtering method.

In this work, we demonstrate the successful use of the hollow cathode (HC) technology to impart water repellent property on polyolefin fabric with silicone precursor. The effects of parameters such as power, pressure and gas mixture on waterrepellencyare evaluated according to international standards such as the resistance to surface wetting. The water repellent finish has a resistance surface wetting of 4.5 and decreases steadily after several wash cycles.

In addition, we show the deposition of low-emissivity coatings prepared by roll-to-roll on a 1.6-m wide fabric. The low-E property is obtained by magnetron sputtering of metal layer (*e.g.* aluminium) and silicone polymer by HC-PECVD. Here, the silicone polymer is used as a corrosion protection barrier. The low-E layer displays an emissivity of 0.2 and 0.25 after 48h in saline water.

11:20am **G4-WeM-11 Amorphous Carbon Coatings on Glass for High Voltage Protection***, **Hana Barankova**, L. Bardos,* Uppsala University, Sweden

Radio frequency Hollow Cathode based hybrid process integrating both Physical Vapor Deposition and Plasma Enhanced Chemical Vapor Deposition was used for deposition of amorphous carbon directly on glass, without using any interlayer. The films grown at 0.25 – 0.5 % of acetylene in the mixture with argon were subjected to high voltage pulses and the performance was compared with uncoated glass samples to test the protection ability of the films, the ability to prevent the deteriorating effects of corona flashovers/arcs. In contrast to the uncoated glass the well adherent carbon films with thicknesses between 3.5 and 17 µm exhibited an excellent protection of the glass substrate against the flashovers/arc damages in both polarities of the electric field with voltages up to 300 kV.

11:40am **G4-WeM-12 Plasma Pretreatment of Small Parts and Granular Materials in Bulk Vacuum Coating***, **Heidrun Klostermann**, B. Krätzschmar, F. Fietzke,* Fraunhofer FEP, Germany

Bulk coating seems to be an intriguing variant of vacuum coating for small mass parts. Compared to individual part coating, the handling effort is considerably reduced. This applies to indirect and direct labor such as the production and maintenance of adapted fixtures and the charging and de-charging of individual parts. Furthermore, the utilization of processing volume can be maximized, avoiding void space between the parts. This benefit turns into a drawback during plasma etching due to the competitive processes of sputter cleaning and re-deposition on the parts. However, plasma pretreatment of the surfaces is an indispensable step also in bulk vacuum coating. Otherwise, the permanent mechanical impact during agitation will entail delamination defects due to interface imperfections. Identification of appropriate plasma pretreatment regimes is as important as the coating step itself.

In case of granular materials, the aspect of an effective removal of adsorbents before the coating step is a major issue. It becomes more and more challenging with decreasing grain size, hence increasing outer surface area of an ever bigger number of grains, and even more difficult if the grains consist of porous material, where inner surfaces are loaded with adsorbates as well.

Fraunhofer FEP is developing coating equipment and technology for an efficient coating of small parts and granular materials. Depending on the application, adapted plasma pretreatment steps based on a hollow cathode plasma source are established. In this contribution two applications will be presented: 1. the plasma pretreatment of small metallic parts, 2. The plasma heating of hygroscopic porous granular material. In both cases, the pre-treatment steps are essential for the whole processing and have a big effect on the resulting coating. To establish such processes, many aspects have to be considered: 1. Generation of a sufficiently dense plasma close to the bulk of substrate material to be treated, 2. Identification of parameters for effective material removal, 3. Verification of a sufficient and uniform treatment of the batch, 4. Qualification of etching efficiency, 5. Coating qualification including the indirect approval of the pretreatment step. The presentation will give insight into procedures and results along this sequence.

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