

Plasma Coatings – From Results to Innovation

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Abstract

The use of plasma coatings is highly attractive to enhance biomaterials such as sensors, scaffolds, antibacterial surfaces and others. Control over the formation of plasma coatings on the nanoscale enables ultrathin films providing new surface properties. Investigations regarding mainly the interaction with bacteria and proteins will be presented.

2 nm-thick hydrophobic cover layers on PDMS substrates of different crosslinking degree are used to clarify the role of viscoelastic properties on bacterial growth indicating the lack of mechanosensing abilities. Likewise, hydrophobic cover layers with varying film density are explored to control water intrusion. Thus, a defined volume of water can be allowed to penetrate a porous base layer. Protein adsorption of BSA is found to be affected by this hydration effect due to orientation of water molecules in the subsurface. Moreover, controlled drug release from a Ag reservoir is enabled for long-term antibacterial properties. On the contrary, undesired release from conductive Ag-coated textile electrodes as used for ECG sensings can be avoided by passivation.

Recent progress in the understanding of plasma deposition processes enables increased control and usability of functional plasma coatings at the nanoscale. Dry and environmentally friendly processes can thus be implemented meeting the requirements for industrial applications.

Biography

Dr. Dirk Hegemann graduated in physics and earned a PhD degree in materials science from TU Darmstadt, Germany. As a scientist he worked with the Fraunhofer Institute for Interfacial Engineering and Biotechnology in Stuttgart, Germany, before moving to Empa, the Swiss Federal Laboratories for Materials Science and Technology, in 2003. Currently, he is leading the group Plasma & Coating at Empa's laboratory for Advanced Fibers in St.Gallen, Switzerland. The main focus of his work concentrates on the plasma treatment of polymeric substrates such as scaffolds, membranes, textiles, packagings etc. by plasma etching, plasma polymerization, and sputtering processes. Process development and reactor design enable the transfer to industry.

Dirk Hegemann is appointed to the board of directors of the Swiss Physical Society (SPS) as well as the International Plasma Chemistry Society (IPCS) and acts as Editor-in-chief for the journal Plasma Processes and Polymers.

