

Workshop »Coatings for Biomedical Applications«

Molecular Plasma – Atmospheric Surface Functionalization for Biomedical Applications

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Unlike traditional atmospheric plasma technologies that focus on surface activation or cleaning, mpg's single-step, dry, solvent-free process uses cold atmospheric plasma to covalently bond organic chemistry onto any substrate. This creates a permanent nano-coating with a clearly defined surface functionality. Besides the wide range of chemicals that can be processed, it is also the flexibility of treating diverse substrate geometries that makes this technology unique. Starting from small surfaces, fibres, 3D shapes, powders and particles, the homogeneous and continuous coating of large substrates, foils, membranes, or textiles is also feasible.

In the field of biomedical applications, for example, bioactive surfaces can be generated in order to improve the adhesion and growth of cells. This is used, among other things, for implants, scaffolds, endovascular prostheses or 3D cell structures (e.g. for realistic drug screening). In contrast, anti-biofouling coatings prevent the adsorption of proteins and adhesion of cells to parts such as catheters, implants, biosensors, endovascular prostheses, or microfluidic systems. Compared to the commonly used PEG, which is water-soluble and therefore challenging to immobilize onto surfaces of biomedical interest, the longevity of the functionalization can be increased, with even improved microfluidic properties. Another application of the technology is the creation of antimicrobial surfaces, as for instance for filter media or medical protective clothing.

A significant advantage towards common processes offers the possibility to directly deposit biomolecules on a substrate in an environment-friendly and single-step process, without the need of another linking layer being applied in advance. For example, proteins or more specifically antibodies, peptides, are added to the plasma and covalently bound on the surface without losing the function of the biomolecules. In this way, complex, time-consuming, and cost-intensive wet-chemical pre-treatments can be replaced by a process that is up to a thousand times faster, also reducing the chemical consumption by a hundred times.

Other functions relevant to medical technology are hydrophobic, hydrophilic or release coatings, but also targeted filtration, corrosion protection or the improvement of adhesion properties on inert or sensitive materials.