

# PRESS RELEASE

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## Surface engineering with atmospheric pressure plasma processes for biomedical applications

**Cost-effective plastics are used for many medical disposable products. Often they do not only have to be biocompatible but also require defined surface characteristics or need to be functionalized for the subsequent coupling of biomolecules. Atmospheric pressure plasma processes such as those used and developed at the Fraunhofer IST offer a variety of possibilities for changing the physical or chemical characteristics of surfaces so that they can be used for biomedical applications.**

The interactions at the boundary layer between the material and medium or biomolecule play a crucial role in the cultivation of cells, the development of medications and biosensors, or the use of medical products such as stents or tubes. However, materials such as plastic or glass are often used for biomedical products, with surfaces that are inert, so that the surface characteristics have to be specifically established. The Fraunhofer IST develops processes for surface functionalization or coating by means of atmospheric pressure dielectric barrier discharge.

With this technology, a cold physical plasma is ignited and used to treat the surfaces of a wide variety of materials that can even be temperature sensitive. Given suitable process control, it is for example possible to improve the wettability with polar media such as water, also in capillary or porous structures. The specific functionalization of surfaces is also possible by producing chemically reactive groups: Amino or epoxy groups for instance are suitable for the subsequent coupling of biomolecules such as enzymes, antigens, or antibodies. Nitrogenous groups on surfaces such as primary and secondary amines promote adherent cell growth and thereby permit the efficient cultivation of various cell types.

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**FRAUNHOFER INSTITUTE FOR SURFACE ENGINEERING AND THIN FILMS IST**

In addition to universal suitability for many different substrates – from plastic to glass or metal to textiles and leather – a key advantage of atmospheric pressure plasma processes is that they can be used for many different applications in terms of the substrate geometry. Complex geometries can be modified in addition to flat substrates and even interior coating is possible. This makes the technology suitable among other things for the treatment of PCR tubes, microfluidic systems, bags, or scaffolds. Compared to other, often wet chemical processes for surface treatment, the benefit of atmospheric pressure plasma processes is that they are solvent-free and only require comparatively short process times.

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A current example for the successful use of the technology is being presented at the joint Fraunhofer exhibition booth at Biotechnica 2017 in hall 19/20, booth B02. LabBag®, the novel “laboratory in a bag” for the cultivation of stem cells, was developed by the Fraunhofer IST jointly with two other Fraunhofer institutes, the Fraunhofer Institute for Biomedical Engineering IBMT and the Fraunhofer Institute for Process Engineering and Packaging IVV. The interior surface of the sterile sealed bag is functionalized using the atmospheric pressure plasma process. After adding the nutrient solution under sterile conditions, “hanging droplets” form by themselves on the inner surface of the bag for the cultivation of stem cells.



**Atmospheric-pressure plasma treatment at the Fraunhofer IST: Improved stem cell growth on the surfaces of plasma-coated bags. © Fraunhofer IST, Falko Oldenburg.**

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As an industry-oriented R&D service center the Fraunhofer Institute for Surface Engineering and Thin Films IST bundles skills and expertise in the fields of coating production, coating application, coating characterization and surface analysis. The aim is to provide the surfaces of the most diverse substrate materials with new or improved functions so as to create innovative products in line with market requirements. The Fraunhofer IST is one of the sixty-nine institutes of the Fraunhofer Society, Europe’s leading research organization, and with its 130 employees has an operating budget of 12.2 million euros.