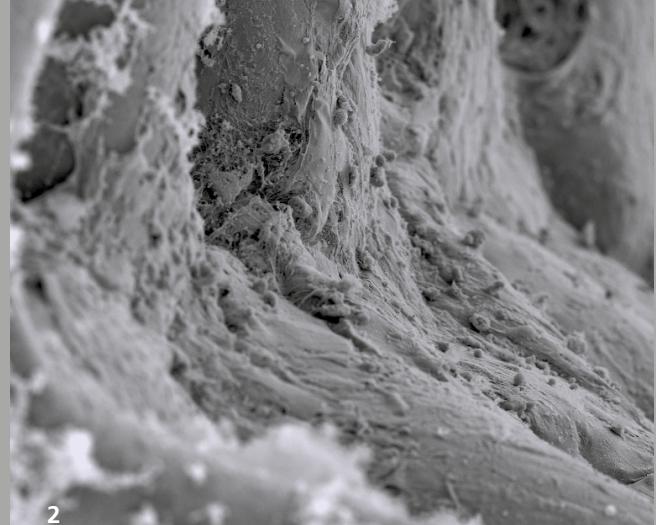




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**Extract from the annual report 2013
To the website: www.ist.fraunhofer.de/en.html**

COATINGS FOR CELL CULTIVATION

Multipotent and pluripotent stem cells are an important starting point for trend-setting therapies. Their cultivation requires materials and substrates which must not only be inexpensive but also offer safe use and handling. To be able to multiply, the cells themselves need a suitable surface to adhere to. To create this even in closed systems, the Fraunhofer IST is developing coatings using atmospheric-pressure plasma processes.

Atmospheric-pressure plasma processes for optimum surface properties

For many biological applications, such as cell cultivation and differentiation, control of cell adhesion on different materials plays a decisive role. At the same time, material properties such as sterilizability, biocompatibility or mechanical stability must be supported. Cell-specific surfaces with retention of the original material properties can be realized for example through a coating. One possibility here is offered by dielectric barrier discharge (D) at atmospheric pressure. With this technology, a large number of inert surfaces, such as plastics, glass or silicon wafer, can be modified such that the materials are usable for adherent cell cultures. The process is characterized by short process times and dispenses with vacuum or solvents. The surface properties adapted to the cells are possible even with complex substrate geometries. Moreover, different surface composition can be varied due to the use of different film forming agents. This results in a very great potential of this technology in cell culture applications.

Example: cell cultivation in the bag

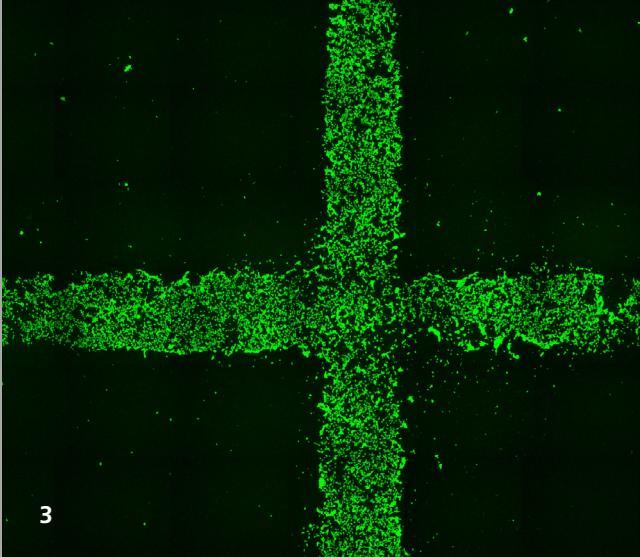
GMP-conformant cultivation systems are of special importance in the cultivation of cells for therapeutic purposes. With a D-based process running at atmospheric pressure, cell-adherent coatings can be applied in closed plastic bags without the bag having to be opened during the coating and cell culture process, the system remains sterile.

Example: regenerative medicine

In the field of regenerative medicine, such as for bone replacement, biocompatible supporting structures—so-called scaffolds—have an important role to play. Here atmospheric-pressure plasma processes also offer a promising way of modifying the surfaces of these three-dimensional structures so as to improve their colonization with cells and thus the yield from cultivation.

Example: location-selective cell cultivation

For certain types of cell, such as nerve cells or pluripotent stem cells, a location-selective modification of the surface is of great interest. This can be achieved by the so-called



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“plasma printing” process. With a suitable gas supply and using electrodes adapted to the desired structure, almost any structured coating can be deposited on flat substrates by atmospheric-pressure plasma processes. Surface coating matched to the cells opens in turn the possibility of location-selective cell cultivation on the most varied substrates.

Outlook

A combination of the three described application examples is of great interest particularly for cells with therapeutic relevance which make serious demands of the cultivation process. Plastic bags which have had a structuring treatment could, as GMP-conforming systems, considerably simplify the cultivation of pluripotent stem cells. There is even a great potential for innovation in coating scaffolds within a closed bag, processed under GMP-conforming conditions

1 *Plasma in the bag.*

2 *Adherent growth of MC3T3 cells on the coated scaffold.*

3 *Adherent growth of HEK 293-LP cells on structured coated polypropylene film.*

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