



- 1 *Plasma setup for the development of textile finishing processes.*
- 2 *Application in sports and outdoor activities.*
- 3 *Textiles for personal protective equipment (PPE).*

PLASMA FINISHING OF FIBERS AND TEXTILES

Advantages of plasma finishing

Due to increasing requirements for textile fabrics, increasing price pressure and increasing demand for environmentally friendly processes in the textile industry, innovative production techniques are in demand. As an innovative and versatile method, plasma technology has distinct advantages over other finishing processes: It is very energy efficient, requires a minimum of chemicals, and can even be applied to inert materials.

What is plasma technology?

Plasmas are partially or fully ionized gases containing ions, electrons, radicals, and electronically excited particles. These species interact with almost any material, thus permitting modifications which cannot be achieved even by wet-chemical treatment.

Depending on the process parameters, fibers and textiles can be modified in various ways: the materials can be cleaned, chemically activated, equipped with functional groups, or coated.

Plasma modification results in many properties, such as

- Antistatic finishes
- Controlled wettability, e.g. hydro- and oleophobic finishes
- Improved dyeability
- Flame retardant finishes
- Biocompatible finishes
- Anti-fouling finishes
- UV-protection
- Anti-icing finishes
- Anticorrosive finishes
- Biocidal finishes (e.g. insect repellent)

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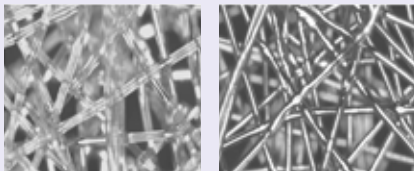


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Examples of plasma finishings on textiles



Anti-corrosive coatings

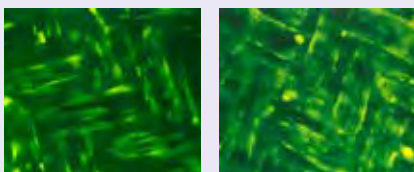
Optical microscope images of metalized (aluminum coated) polyester nonwoven after corrosion test (water condensation test 98°C, 2h). Without coating, corrosion takes place (left). With a plasma coating, no corrosion can be recognized (right).

Project partner: ROWO Coating GmbH



Modified wetting behavior

Colored water droplets on a hydrophobic plasma coated textile (left) and on a hydrophilic plasma coated textile (right).



Plasma coating of medical textiles

Plasma coated medical textile favoring cell adhesion (green colored cornea cells).

Applications

■ Fiber-matrix adhesion

With chemical functionalization, the fiber matrix adhesion of polyolefines, aramid and carbon fibers to elastomers can be improved. Applications in tires, gaskets, valves, composite materials, etc.

■ Separation and filtration

With surface functionalization, the affinity of membranes to chemicals can be controlled. Applications in phase separation (planar membranes), biomedical applications (hollow fiber membranes for dialysis), etc.

■ Water and ice repellent coatings

With surface coatings, the adhesion to the surface can be reduced. Application on outdoor clothing, footwear, tents, backpacks, building fabrics, etc.

- Rising price pressure with, at the same time, increasing energy and raw material costs
- Demand for customized products

To fulfill these requirements, new processes have to be established. Plasma processes offer a broad spectrum of possibilities and also an excellent adaptability to changing demands.

Our services and equipment

- Process development
- Quantification of treatment results and quality assurance by surface analytics and testing (wettability, repellence, biocompatibility, etc.)
- Literature research and market studies
- Job-shop coating for small batch sizes
- Pre- or post-treatment such as drying or grafting

Outlook

The textile industry has to fulfill a variety of new technological requirements with consequences for the European and American markets.

- Conformity with environmental standards (e.g. REACH)
- No usage of C8-PFCs, avoidance of other PFCs for hydro- and oleophobic finishes whenever possible
- Increasing demands on safety of the production process and working place
- Increasing requirements regarding the performance of the products, personal safety (ÖKOTEX standards), and comfort

In addition to various smaller laboratory scale plasma reactors, Fraunhofer IGB has two plasma chambers for web treatment. Besides this, fiber treatment can be performed on two setups.

- 4 *Dirt-repellent finishings.*
- 5 *Fleece before (left) and after plasma finishing (right).*