New fibers and membranes for high-tech products

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Measuring light losses in a polymer optical fiber.

Nothing escapes the attention of research and development scientists, and now is the turn of industrial garments and household textiles! Manufacturers can now take advantage of new raw materials, fibers and membranes, not to mention the technological progress which makes numerous high-tech products now possible. Several of these innovations were presented at the biennial Textile Conference held this autumn at Empa.

In recent years the field of materials research relating to applications for textiles has seen extraordinary progress. The result is not just new manufacturing processes, but also in particular new materials ranging from special organic and inorganic fibers to the most modern

membranes. The textile industry is profiting from these new developments, exploiting them for its high-tech products. At the Empa Textiles Conference attendees were shown innovations which have already been converted into products, as well as the newest research results and what potential they hold.

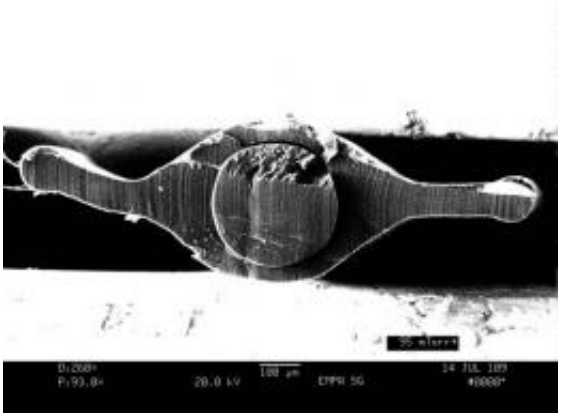
Fibers – flexible miniature structures with a large span of properties

To begin with the conference was all about fibers. Lukas Scherrer, from Empa's «Protection and Physiology» laboratory, presented some which transmit light. They are perfectly suited to creating fashionable decorations, but they also make possible extremely useful technical and medicinal applications such as pressure and gas sensors, pulse measuring devices and textiles for photodynamic cancer therapy.

Martine Kolischer of DuPont also presented a special polymer fiber which is made entirely of a regrowable raw material - maize – and requires 40 per cent less energy to manufacture than types produced by chemical means. «Sorona», as it is branded, can be used to create supersoft, elastic fabrics which dye well and are resistant to chlorine and UV-light, thanks to the unique zigzag shape of the molecules of which it is made. Articles of clothing made from Sorona hold their shape very well and body heat is sufficient to iron out creases. A critical question from the audience asked whether the use of an agricultural product grown for human and animal food as the raw material for such a "wonder fiber" was ethically acceptable. Kolisher's response was that only 0.01 per cent of the US's farming land was used for manufacturing the fiber, which is currently exclusively available there.

Fibers made of the mineral basalt were also praised as "wonder fibers" by Andreas Bartl of the technical University of Vienna, although in this

case the application was not for clothing but for wind turbine rotor blades, in the automobile industry and in other technical fields. Thanks to their excellent physical and chemical properties and low price these new fibers offer a perfectly acceptable alternative to glass and carbon fiber based materials. In a similar vein, Thomas Graule of Empa's "High Performance Ceramics" laboratory reported on the outstanding characteristics of ceramic fibers as functional materials which are finding applications, for example, as piezoelectric actuators and sensors in the mechanical engineering field.



A bicomponent fiber imaged under the scanning electron microscope. The core of the fiber lends it the required stiffness whilst the sheath, of a different polymer material, gives it other desirable properties, for example optimal sliding properties.

Cellulose fibers for innovative textile applications were the topic of a presentation by Frank Meister of the Thuringian Institute of Textile and Plastics Research. Relatively large, fillable hollow spaces in these fibers lend them (and therefore fabrics made of them) various properties useful for hygienic or bioactive products, depending on the substances used as the filling. Also involved in the development of multicomponent fibers

for functional textiles is Empa's "Advanced Fibers" laboratory, whose work was presented by Rudolf Hufenus. Novel fibers made of different polymers and having variable cross sections are produced using special pilot spinning equipment. These fibes are used, for example, to make artificial grass surfaces, for antimicrobial textiles or to reinforce concrete. Synthetic turf made from a polymer-based bicomponent fiber, which was developed by Empa in cooperation with industrial partners, is already commercially available.

Membranes – irreplaceable in the functional garment field

Sympatex and the Swiss company Mammut, two manufacturers of functional clothing, gave presentations showing how and where they use polymer-based membranes in their outdoor clothing ranges and demonstrating that these products now represent irreplaceable and integral components of such garments. They also expressed a wish, directed at the manufacturers of such membranes, that test procedures be standardized, thus making the results easier to compare. Enhanced durability would also be very desirable, so that membranes would retain their initial quality even after being washed ten times. In addition the recyclability, and therefore the sustainability, needed to be improved– a challenge directed at the scientific community. Ana-Maria Popa of Empa's «Protection and Physiology» laboratory reported to the conference on the institute's research activities in the field of adaptive membranes. These are textile systems which automatically adjust to the environment surrounding them. She also described fibers which can be used to release doses of drugs and therefore make possible new applications in the field of medicine.

Provided by Empa