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9th Empa Textile Conference on Functional Fibers

Finer, longer and ever more multifunctional

They lead light and electricity, are smell-reducing and biocompatible – the functional fibers, much sought after in medicine, industry, fashion and sport. Until they are, however, ready for commercial application, some more research and development are still needed. Therefore, specialists from the textile industry meet every two years at Empa, in order to discuss and exchange current research advances and network with each other. This year the theme of the Empa Textile Conference was: “Development of functional fibers for the well-being of people”.

Textile researchers provide synthetic fibers more and more directly during the production with specific characteristics. These vary ever according to requirement. For instance if bodily functions are to be measured such as heart rate, temperature or blood pressure, the fibers must be capable of conducting electricity. With a nanometer-thin metallization this is ensured – while at the same time the clothes containing these fibers are comfortable and not stiff, since the garments are not reinforced by additional interwoven wires. Sportsmen also benefit from functional fibers: excessive sweat caused by heavy efforts results in an unpleasant feeling when the body cools off. This so called „post exercise chill effect“ can be prevented by the use of fibers with grooved structure, because their capillary effect provides for fast elimination of sweat. For a pleasant constant temperature, so called “Phase Change Materials” also can be utilized. Surplus body warmth originating from physical effort can be stored in these materials, by changing their state of aggregation. When the body cools down afterwards, the stored warmth is again released.

These are only some examples, which were presented to approximately 100 textile specialists attending the conference, most of whom could easily identify with the theme of: Finer and ever more sophisticated fibers. Also combinations – for example textiles containing sensors or medically active substances – are no longer rare. Nanotechnological procedures applied to textiles show great promise. Thus, nanofibers, nanocomposites and nanocoatings are of special interest to textile researchers. Fundamental questions were also discussed, for example: How do

body cells react to nanofibers? What kind of reciprocal effects do exist between molecules and fiber surfaces?

Inspiration from the Fauna ...

Textile research is at present particularly inspired by nature, explains Marc Renner, the Director of the Ecole Nationale Supérieure des Industries Textiles de Mulhouse (ENSITM). Many animals have true «High tech fibers», whose morphologic, physical and chemical characteristics are not always easy to fathom. Thus, in Mongolia at –40 degrees Celsius is usually considered a freeze, but that is not the case, however, with the local Kashmir goats: With extraordinarily fine hair they protect themselves on the extensive steppes against icy winds. The fibers possess a special morphology, that is to say, their surfaces have a structure, which retains warmth.

Spiders too have a large repertoire of thread productions, which are made and used depending upon situation and requirement. Spider silk has astonishing characteristics; so for example, the roping threads of the spider *Nephila clavipes* are stronger than steel and yet pronouncedly viscoelastic.

... and conversion by industry

Since the break-through of the development of synthetic fibers at the end of the 1950's, their production grows constantly world-wide. In 1995 with 20 million tons, the production of synthetic fibers even surpassed for the first time the quantity of produced cotton fibers. At present, more than 35 million tons of synthetic fibers are manufactured each year. Yet, the European textile industry employs 31 per cent fewer workers than ten years ago and since that time, capital investments sank also by a third. For Manfred Heuberger, Head of Empa's Laboratory of "Advanced Fibers", this raises an alarming concern. "Our goal is it to develop innovative products which set investments in motion again". Above all co-operation with small and middle enterprises (SME), are of importance, declared the self admitted "no-tie wearer", who, nonetheless, appeared on the occasion of the textile conference „with above“. Because this tie is a good example of a successful development co-operation between Empa and a Swiss SME, the Weisbrod AG. What is so special about this tie? It does not allow dirt to stay on and is thus protected from Ketchup, wine and coffee stains. While no special fibers were used in the production of this tie, the conventional silk cravatte received a special coating. A further example of the successful co-operation between Empa and the industry is a fiber coated with silver particles which will go into production next year. It makes life for bacteria difficult, can be washed and is comfortable to wear. The homogeneous, only 50 nanometers thin silver layer can be coated on through plasma technology.

In order to make such co-operation for a textile SME worthwhile, the goals have to be clearly defined at the beginning and amended and adopted as may become necessary during the development phase, said Peter Eschler of the Christian Eschler AG, in summarizing important points of view from the perspective of a SME. He is aware, however, that the conflict between industry's need for secrecy on the one hand, and the pressure to publish the research results in technical periodicals on the other, does not make matters easy. Because it is of course crucial for the industry that innovative products are ready as fast as possible for the market, and one's stake in the intellectual property of the development is protected accordingly. Meanwhile, the Christian Eschler AG can point, however, to several successful co-operative projects with Empa. As an example, Eschler refers to the development of a four layer clothing system for the Swiss Army which is going to be introduced next year and is designed through its unique warmth control, to protect Swiss soldiers from wind and weather.

Author: Manuel Martin

“Solution services” – services and industrial co-operation à la Empa

From the first contact with potential industrial partners and up to the production of a „ready for market“ product, Empa's Laboratory of “Advanced Fibers ” offers comprehensive customer services and responds to the requests from the industry. These services, in the context of the offered “Solution services”, reach from the structural analysis of fibers with the scanning electron microscope, over pilot attempts at the melt spinning machine, up to new coatings with pollution free plasma technology.

Further information may be found under: www.empa.CH/portal

Further information:

Dr. Manfred Heuberger, Laboratory Head “Advanced Fibers”, Phone +41 71 274 78 78,

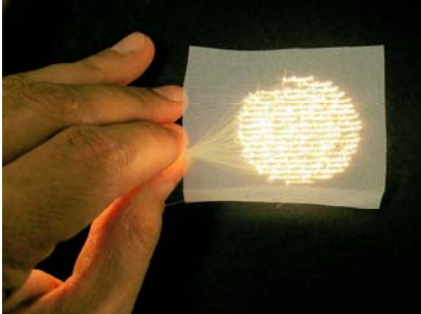
Manfred.heuberger@empa.CH

Hansruedi Forge, Laboratory “Advanced Fibers”, Phone +41 71 274 73 48,

hansruedi.schmid@empa.CH

Contact:

Sabine Voser Möbus, Communications, Phone +41 44 823 45 99, sabine.voser@empa.CH



Light conducting fibers find new applications in medicine; for example, they can illuminate, in the context of the “photo-dynamic cancer therapy”, specified body cavities like the mouth .



Fibers coated with silver particles make life difficult for bacteria.



Manfred Heuberger, Laboratory Head “Advanced Fibers”, welcomed the many specialists from Switzerland and from foreign countries, who attended Empa’s 9th Textile Conference.



After the specialized lectures various poster presentations resulted in lively discussions.