TEXTINATION NEWSLINE **11-12-2019**

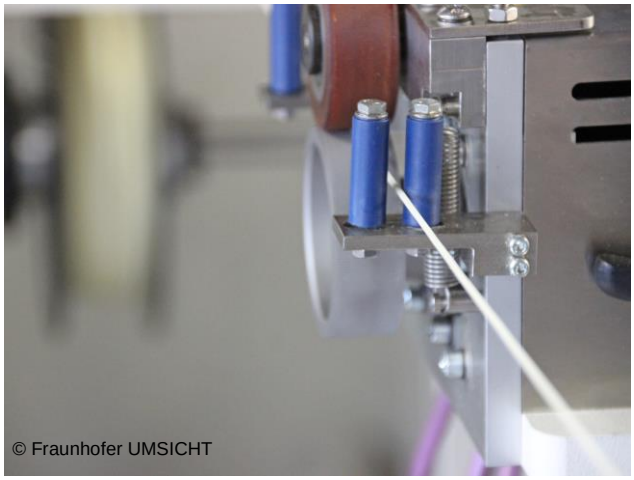
FRAUNHOFER UMSICHT: COMPOUNDS FOR ADDITIVE MANUFACTURING, GEOTEXTILES AND WEARABLES

Fraunhofer UMSICHT

Fraunhofer-Institut für Umwelt-, Sicherheits- und Energietechnik UMSICHT

Whether biodegradable geotextiles, wearables from thermoplastic elastomers or functional textiles from 3D printers - the scope of plastics developed at the Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT is wide.

Insights into these projects were provided from October 16th - 23rd in Düsseldorf: At the K, scientists presented their work on thermally and electrically conductive, biodegradable, bio-based compounds as well as compounds suitable for additive production.



The new AddiTex compound comes out of the extruder as a filament for 3D printing.

Textile composites from the 3D printer

In the "AddiTex" project, plastics were developed that are applied to textiles in layers using 3D printing and give them functional properties. A special challenge in the development was the permanent adhesion: The printed plastic had to be both a strong bond with the textile and sufficiently flexible to be able to participate in movements and twists.

A flexible and flame-retardant compound was developed, which is particularly suitable for use in the field of textile sun and sound insulation, as well as a rigid compound, which is used, among other things, for reinforcing the shape of protective and functional clothing.

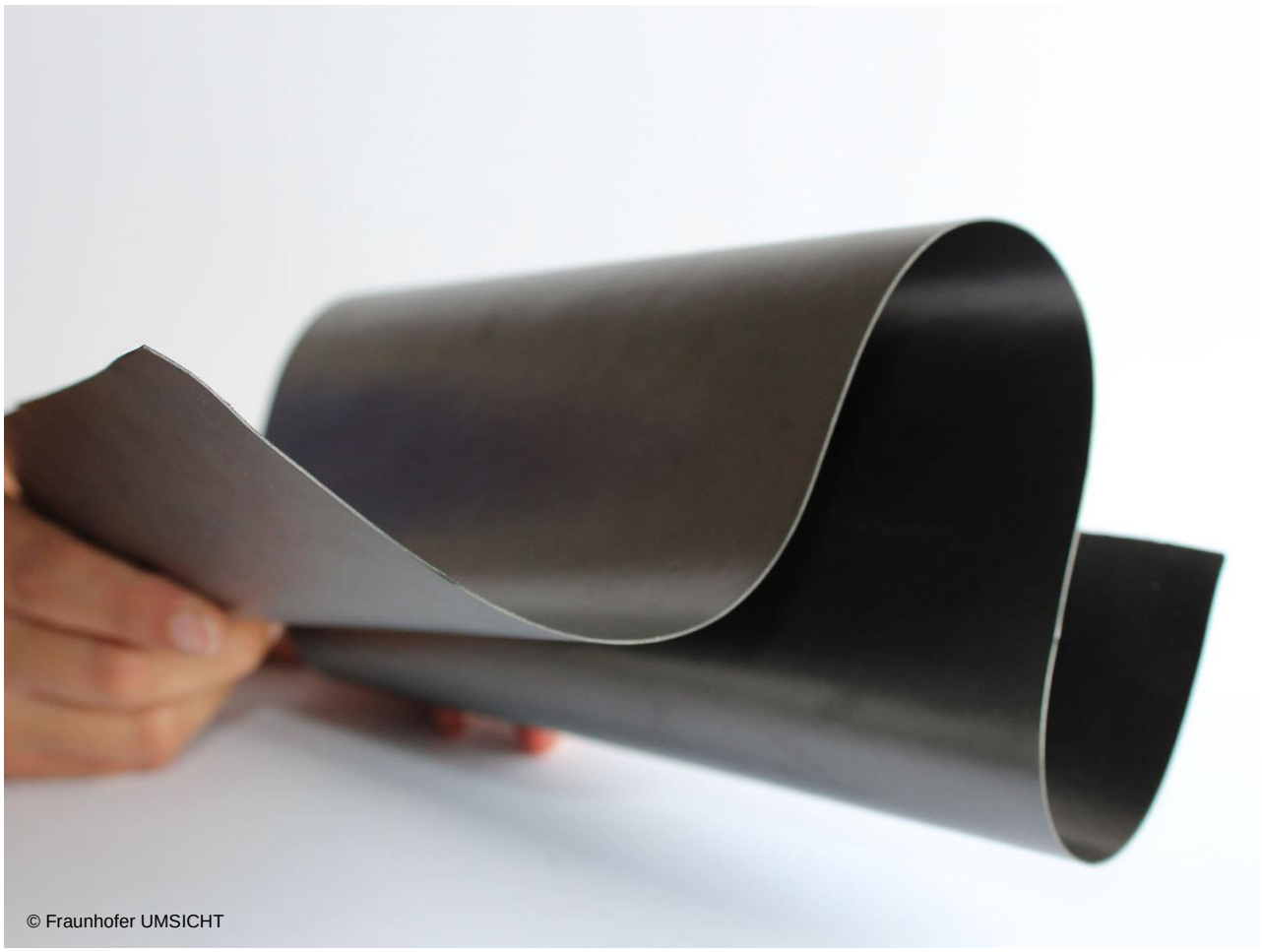
Prototype of a geotextile filter for bank protection.

Geotextile filter for technical-biological bank protection

Geotextile filters for technical-biological bank protection are the focus of the "Bioshoreline" project. It stands for gradually biodegradable nonwovens, which allow a near-natural bank design of inland waterways with plants. They consist of renewable raw materials and are intended to stabilize the soil in the shore area until the plant roots have grown sufficiently and take over both filter and retention functions. The ageing and biodegradation of the fleeces begin immediately after installation, until the fleeces are gradually completely degraded.

Prototypes of the geotextile filters are currently being tested. Female scientists evaluate the plant

mass formed above and below ground with and without geotextile filters as well as the influence of the soil type on plant growth and the biological degradation of the filter.



Flexible plastic compounds can also be used in wearables.

Wearables made of thermoplastic elastomers

In addition, Fraunhofer UMSICHT is developing novel, electrically conductive and flexible compounds that can be processed into thermoplastic-based bipolar plates. These plastics are highly electrically conductive, flexible, mechanically stable, gas-tight and chemically resistant and - depending on the degree of filling of electrically conductive additives - can be used in many different ways. For example, in electrochemical storage tanks (batteries), in energy converters (fuel cells), in chemical-resistant heat exchangers or as resistance heating elements.

Another possible field of application for these plastics: Wearables. These portable materials can be produced easily and cheaply with the new compounds. It is conceivable, for example, to form garments such as a vest by means of resistance heating elements. The idea behind this is called Power-to-Heat and enables the direct conversion of energy into heat.

Source:
Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT

FUNDING NOTES
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The "**Bioshoreline**" project (funding reference: 22000815) is funded by the Federal Ministry of Food and Agriculture (BMEL) on the basis of a resolution of the German Bundestag.

Project goals
The combination of textile surfaces with additively printed, three-dimensional elements enables function optimization and integration as well as a high degree of design freedom. In the AddiTex project, new plastic compounds with material characteristics are being developed, that fulfil the requirements of 3D printing as well as those of the task, e.g. in protective and functional clothing.

Project benefits
The additive manufacturing processes (3D printing) as an automated manufacturing technology for the production of high-performance components are attributed are crucial role. There are also unique opportunities for textile and clothing companies to increase their competitiveness and save resources (new products, decrease of supply-chain integration, CO2 emission reductions).

The project initially developed polymer materials for additive manufacturing on textiles. Based on this, textile composites with previously unrepresentable geometries and properties were created. Application examples include UV and sound insulation or functional and protective clothing.

Plastics for 3D printing technologies
The 3D printing technology of Fused Deposition Modeling (FDM) is used to apply layers of plastic and create three-dimensional structures. The FDM print on textiles is not yet used commercially due to the lack of availability of suitable polymer materials. The filaments available on the market have insufficient additives for the specific industrial requirements. By building up a holistic production system in which new functional materials (compounds) as well as the plastics processing and joining technology including structuring and surface technology (3D printing) are coordinated, the special requirements of the industry are to be taken into account and new textile composite materials are to be created.

Project results
At the same time the material properties given by the application led to problems during processing via FDM, therefor the surfaces of the filaments had to be modified. Another challenge was the permanent adhesion on the textile: The coated plastic should form a firm bond with the textile and at the same time be sufficiently flexible to participate in the movement and stretching of the underlay. This is particularly suitable for applications in the field of textile sun and sound insulation and has already been successfully tested for its suitability by industry-standard tests. Materials in this Shore hardness range are currently not available on the market as FDM filament.

In addition, a stiff, glass fiber reinforced compound was developed, which is particularly suitable for the direct printing of connectors or the mold reinforcement for protective and functional clothing. This should save production steps and reduce costs. In the future, bio-based plastics for the production of textile composites will be tested and further applications developed.

Project partners

- BARLOG plastics GmbH
- Junkers & Müllers GmbH (J&M)
- JUMBO-Textil GmbH & Co. KG
- Hochschule Niederrhein, University of Applied Sciences, Research Institute for Textile and Clothing - FTB