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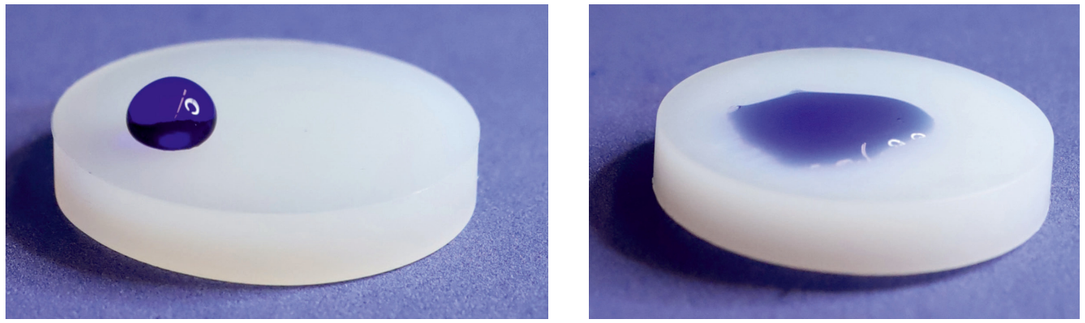
HANSER

Using Plasma Technology to Create Fluorine-Free Products

Polymer Coating as an Alternative to PFAS

PFAS are important for the functionality of many applications. However, due to the impending ban on this group of substances, alternatives are currently being desperately sought. One such option for some areas could be an organosilicon coating produced using plasma technology.



The polymer coating produced using the plasma process (left) has a very good water-repellent effect. The image on the right shows the result without the layer. © INP

The Leibniz Institute for Plasma Science and Technology (INP) in Greifswald, Germany, has developed a method for producing ultra-hydrophobic organosilicon polymer coatings. These coatings are an alternative to per- and polyfluorinated compounds, so-called PFAS (per- and polyfluoroalkyl compounds), which are currently used in many industrial applications and sectors. However, they have been the subject of criticism for some time, which is why substitutes for these substances are being sought.

PFAS compounds have been used for decades to enhance a wide range of products. They play an important role in medical technology and the semiconductor and textile industries, for example. They are water-repellent, therefore offer good non-stick properties and are highly resistant to chemicals. They are also very stable compounds. They can therefore accumulate in the environment and in living organisms and are referred to as "forever chemicals" due to this property. Consequently they are considered harmful to the environment and health and have been banned in some applications in the EU since 2006.

Various countries and regions are currently examining further restrictions. In the EU, for example, a corresponding procedure is currently underway. There are also plans to include all perfluorinated and polyfluorinated compounds in the global ban list of the Stockholm Convention. In future, this could pose a huge challenge for high-tech industries such as medical and semiconductor technology, which rely on the properties of these ultra-hydrophobic coatings.

PFAS Alternative Based on Plasma Technology

The organosilicon polymer coating recently developed by INP is based on plasma technology and is a promising and environmentally friendly alternative to PFAS-containing coatings. It is mechanically and chemically stable, up to 200 nm thick and opaque, storable, washable and reproducible. The coatings can be applied to many materials such as metals, plastics and semiconductors.

Due to these properties and the fact that it can also be applied to thermolabile plastics, the organosilicon polymer coating is ideal for enhancements in medical technology. For example, it can be used for the production or surface modification of implantable devices such as pacemakers and artificial joints.

The INP is currently working on converting the existing organosilicon polymer layer deposition from a low-pressure to a normal-pressure process. Concepts for scaling up the technology are also being developed. "We are very satisfied with the results of our research. The organosilicon polymer layer is a promising alternative to PFAS-containing layers and offers a wide range of possibilities for applications in various industrial sectors," reports Dr. Frank Hempel, head of the Plasma Surface Technology research department at the INP. ■

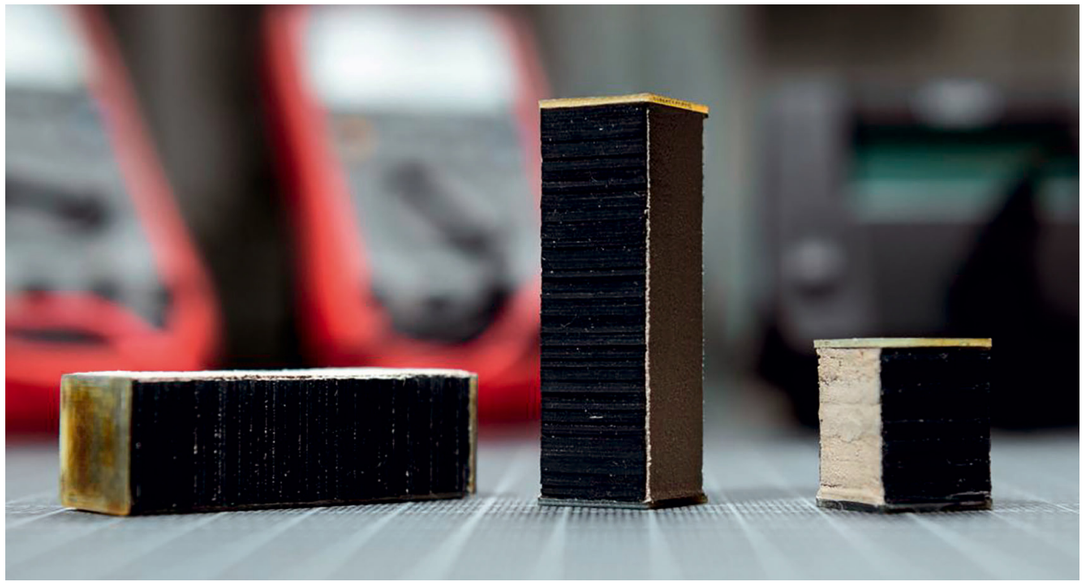
Service

Leibniz Institute for Plasma Science and Technology (INP)
www.inp-greifswald.de/en

Energy-Efficient, Robust, and Sustainable Linear Actuators

DEA Emerging from Research

Dielectric elastomer actuators (DEA) were previously known primarily in the research environment. As part of a collaboration between Momentive Performance Materials, Datwyler and BSC Computer, the technology is to be transferred to series production in 2024 and integrated into initial applications together with key customers.



Dätwyler has developed an automated manufacturing facility to produce DEA stacks on a large scale. © Dätwyler

At CES 2024 in Las Vegas, USA, a development kit for dielectric elastomer actuators (DEAs) was presented for the first time and is now available. The technology is based on electroactive polymers (EAPs).

The three partner companies joined forces to cover the entire value chain, from raw materials to easily integrated DEA stacks with control modules. This ensures the individual components are ideally matched to each other and meet maximum performance and highest quality requirements for the actuators.

The base material, the electroactive polymers, is developed and produced at Momentive's Leverkusen, Germany, location. Datwyler in Schattdorf, Switzerland, manufactures DEAs in unique stacks, which will be produced in increasing quantities by mid-2024 on an in-house developed production line with automated processes.

BSC Computer in Allendorf, Germany, develops and manufactures an electronic control unit that optimally supplies these actuators with the necessary high voltage and an easy-to-integrate digital interface between the linear actuator and the application. In addition, BSC Computer supports end users with the mechatronic integration of the EAP actuators into the end customer application. The advantages of the new technology include: low energy consumption, reduced mechanical parts, reductions in component weight and volume, robust and resilient design, silent and controlled actuation operation.

Continuous Optimization of End Applications Possible

This comprehensive solution digitizes the basic technology of "electroactive polymers." Data obtained via the control unit and the networking of products via the Internet of Things (IoT) enables partner companies to draw conclusions about the performance of the technology. This facilitates continuous and sustainable optimization of end products – from the base material to the stacks and the end customer application. ■

Service

Further information about the project partners:
www.datwyler.com
www.momentive.com/en-us
bscgmbh.de/en