Institut "Jožef Stefan" Ljubljana, Slovenija

TECHNOLOGY OFFER

MAKING TEFLON® AND OTHER FLUOROPOLYMERS HYDROPHILIC

Fields of use
Teflon®, fluorinated polymers, plasma surface treatment, hydrophilic

Current state of technology
TRL 4, technology is ready to be licensed out

Type of cooperation
Technical cooperation and license agreement

Intellectual property
Patent application filled in 2019

Developed by
Jožef Stefan Institute

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Summary

The Jožef Stefan Institute has developed a novel method for surface treatment of polytetrafluoroethylene (PTFE, Teflon®) and other fluorinated polymers, which significantly improves wettability of the surface from highly hydrophobic to highly hydrophilic. We are looking for producers of PTFE and other fluoropolymeric products for license agreement or technical cooperation agreement.

Description of the invention

The wettability of polymer surfaces is an important consideration in some applications, for example where adhesion to the polymer surface is needed, such as when paint, print or functional coatings are applied to polymer substrates, or glue is used to stick a polymer substrate to something else. It may therefore be desirable to modify the polymer substrate surface.

Several methods for modification of polymer wettability have been reported. These include treatment with aggressive liquids, plasma and reactive gases. A known and widely used method is treatment of polymer materials with gaseous plasma. A technological challenge, however is formation of oxygen-rich functional groups on the surface of a fluorinated polymer. Currently used plasma treatment methods lead to etching rather than to functionalization of fluorine-containing polymers with oxygen-rich functional groups.

The solution: Novel two-step plasma treatment of PTFE (Teflon®) and other fluoropolymers to make it hydrophilic.

The present technology offer relates to novel method for modification of surface wettability of fluorine-containing polymers by sequential two- step treatment.

The method is rapid and enables treatment of fluorine-containing polymers of almost any shape and size including 'infinite' materials such as foils. A surface layer of an object made from a fluorine-containing polymer is depleted of fluorine upon interaction with gaseous plasma rich in ultraviolet radiation. The depleted surface layer is then oxidized. The wettability of objects made from or containing fluorine-containing polymers treated according to the methods of invention is close to the theoretical limit for smooth polymers well functionalized with polar functional groups. Figure 1 shows achieved water contact angle values versus a treatment parameter. The contact angle in this case is 20°. Lower angles are achievable for selected fluorine-containing polymers.

A surface finish with novel method is stable and assures for reasonably longlasting hydrophilicity of otherwise hydrophobic polymers. Unlike conventional treatment of fluorinecontaining polymers with oxygen plasma, the novel method does not produce hazardous gases such as oxy or peroxy fluorinated carbon compounds.

KONZORCIJ ZA PRENOS TEHNOLOGIJ IZ JRO V GOSPODARSTVO

EUROPEAN UNION
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The surface treatment method has been validated in laboratory. Additionally, a device for surface treatment of fluorinated polymers in a batch or continuous mode has been developed.

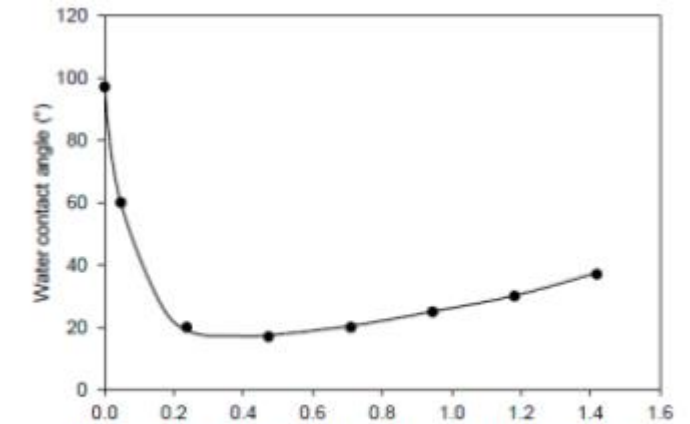

Figure 1: Graph showing the achieved water contact angle of treated PTFE.

The technology has been developed at the Jožef Stefan Institute, Slovenia. The Jožef Stefan Institute is leading Slovenian research institute with more than 1000 employees. The research group of The Department of Surface Engineering and Optoelectronics comprises experts in the field of surface treatment with emphasis on plasma technologies, thin films and vacuum science and have numerous experiences in cooperation with industry.

Main Advantages

- The wettability of fluorinated polymers treated with novel method is close to the theoretical limit for smooth polymers (20° water angle contact);
- The method is fast and amenable to scale up and enable continuous processing;
- There is no measurable production of hazardous or harmful byproducts;
- The method is energetically efficient and can be fully automated.

Partner Sought

We are looking for producers of PTFE and other fluoropolymeric products for license agreement or technical cooperation agreement.

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