Fraunhofer IWS

FRAUNHOFER INSTITUTE FOR MATERIAL AND BEAM TECHNOLOGY IWS

PRESS RELEASE

Clean without scrubbing and using chemicals

Dresden scientists develop self-cleaning aluminum surface

(Dresden, May 27, 2020) Dresden scientists have developed a self-cleaning metallic surface. A project team of the Technische Universität Dresden and the Fraunhofer Institute for Material and Beam Technology IWS structured an aluminum plate with a laser process in such a way that water droplets can roll at its surface and thus remove dirt particles – completely without chemical cleaning agents or additional effort. The scientific evidence of the self-cleaning effect has been published in the journal "Applied Surface Science".

For several years, scientists at TU Dresden and Fraunhofer IWS have been developing functionalized surfaces by means of laser-based manufacturing processes. Now, they have created a periodic surface structure that is not only water and ice repellent, but also removes dirt particles solely by rolling water drops. In this context, they particularly focused on the material aluminum. "This material is used in many industrial branches – either in the automotive sector, aircraft construction or the food industry. The use of aggressive cleaning chemicals is particularly critical in food industry, as we naturally do not want to bring these chemicals in contact with our food," emphasizes Stephan Milles, PhD student at Technische Universität Dresden. In particular, the Dresden scientists studied the function of self-cleaning laser-structured aluminum. A special camera was used to analyze the self-cleaning effect of the aluminum surfaces and filmed the process at 12,500 frames per second. Thomas Kuntze, scientist in the Microtechnology Technology Field at Fraunhofer IWS, explains: "This way we can perfectly see how a water drop can remove the dirt from the aluminum surface. This method is also suitable for understanding other processes, such as laser cutting and welding or additive manufacturing".

About the Center for Advanced Micro Photonics (CAMP)

In close cooperation with Fraunhofer IWS, the Chair of Large Area Laser Based Surface Structuring at TU Dresden is operating the "Center for Advanced Micro Photonics" – CAMP. Prof. Lasagni explains: "We are currently working on several exciting projects with the goal of producing large-area fine-structured structures on metals, ceramics or polymers in the shortest possible time". In these projects, the scientists are continuously developing further a technology known as "Direct Laser Interference Patterning", which offers extraordinary properties compared to classical laser-based

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processes. Examples of such developments are applied in the "LAMPAS" and "SHARK" projects funded by the European Union. Here the scientists design laser sources and intelligent structuring processes to provide profitable solutions for surface functionalization in various fields of application, such as automotive, food and home appliance industries.

Background

The project "Fabrication of large area two and three-level multiscale structures with multi-functional surface properties using laser fabrication methods" was funded by the German Research Foundation (DFG) as part of the Reinhart-Koselleck project (Project number: 323477257). Professor Andrés Lasagni, holder of the professorship for laser-based methods for large-area surface structuring (LMO), heads the project. The full article can be read in the journal Applied Surface Science. Dr. Marcos Soldera supported this research, who followed the Alexander von Humboldt Foundation's call from Argentina to Germany to carry out applied research.

About Technische Universität Dresden

Technische Universität Dresden (TUD) is one of the top universities in Germany and Europe. Strong in research and considered excellent with respect to the range and the quality of degree programs it offers, it is also closely interconnected with culture, business and society. As a modern university with a broad array of disciplines and with its five Schools it has a diverse scientific spectrum that only few other German universities are able to match. TUD is Saxony's largest university with approximately 32,000 students and 8,300 employees – among them 600 professors.
Since 2012, TU Dresden has been one of eleven Universities of Excellence in Germany. It was able to successfully defend this title on 19 July 2019.

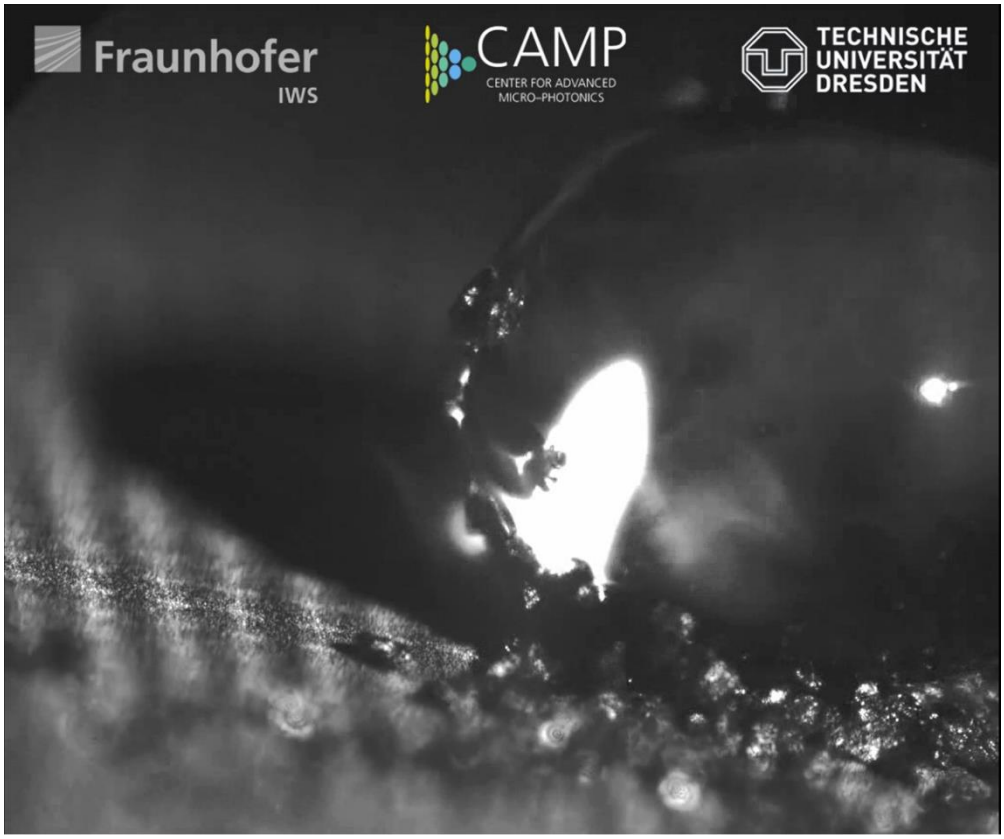
Further information

Link video at YouTube:
https://www.youtube.com/watch?v=M8YCISLZYoo

Link publication:
https://www.sciencedirect.com/science/article/abs/pii/S0169433220312757

Chair of large area laser based surface structuring at TU Dresden:
https://tu-dresden.de/ing/maschinenwesen/if/lmo

Center for Advanced Micro Photonics (CAMP):
https://www.iws.fraunhofer.de/en/centers/camp.html



Water drops do not adhere to the self-cleaning aluminium surface. The latter has been functionalized by a team of "CAMP" scientists using direct laser interference patterning (DLIP).
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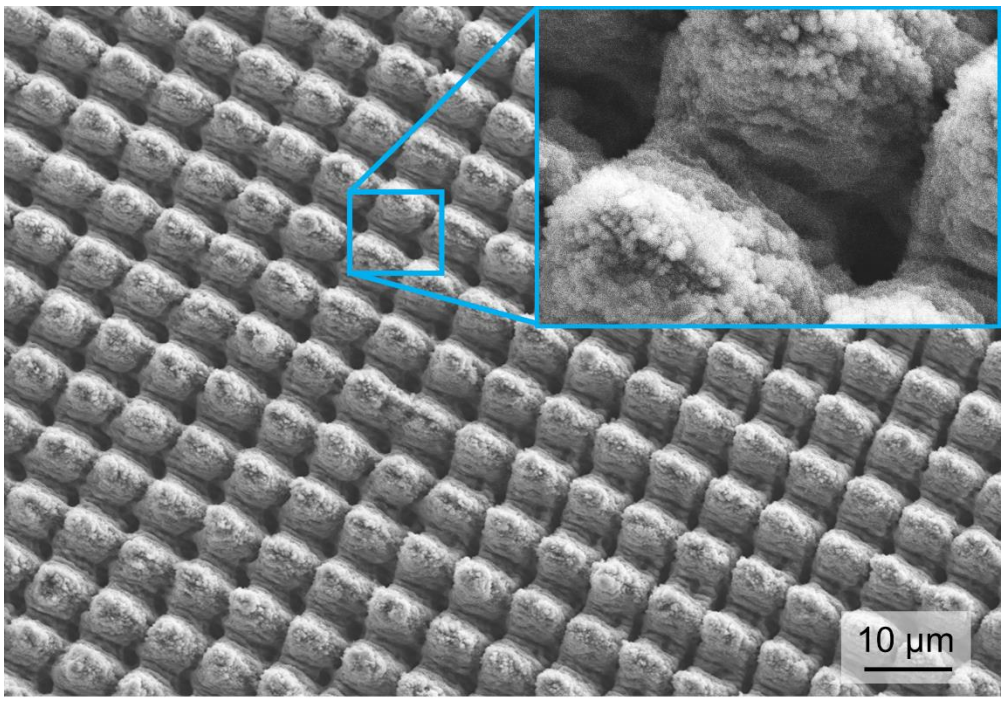

TECHNISCHE UNIVERSITÄT DRESDEN

CAMP CENTER FOR ADVANCED MICRO-PHOTONICS

Fraunhofer IWS

The project "Fabrication of large area two and three-level multiscale structures with multi-functional surface properties using laser fabrication methods" was funded by the Deutsche Forschungsgemeinschaft (DFG).

The **Fraunhofer Institute for Material and Beam Technology IWS Dresden** stands for innovations in laser and surface technology. As an institute of the Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., IWS offers one stop solutions ranging from the development of new processes to implementation into production up to application-oriented support. The fields of systems technology and process simulation complement the core competencies. The business fields of Fraunhofer IWS include PVD and nanotechnology, chemical surface technology, thermal surface technology, generation and printing, joining, laser ablation and separation as well as microtechnology. The competence field of material characterization and testing supports the research activities.
At Westsächsische Hochschule Zwickau, IWS runs the Fraunhofer Application Center for Optical Metrology and Surface Technologies AZOM. The Fraunhofer project group at the Dortmund OberflächenCentrum DOC® is also integrated into the Dresden Institute. The main cooperation partners in the USA include the Center for Coatings and Diamond Technologies (CCD) at Michigan State University in East Lansing and the Center for Laser Applications (CLA) in Plymouth, Michigan. Fraunhofer IWS employs around 450 people at its headquarters in Dresden.

A project team of TU Dresden and Fraunhofer IWS structured an aluminum plate in such a way that water droplets no longer adhere to it and dirt particles can be removed from the surface (Dr. Marcos Soldera, Thomas Kuntze, Stephan Milles and Prof. Andrés Fabián Lasagni, from left).
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