Lotus leaf inspires scientists to create world's first self-cleaning metals

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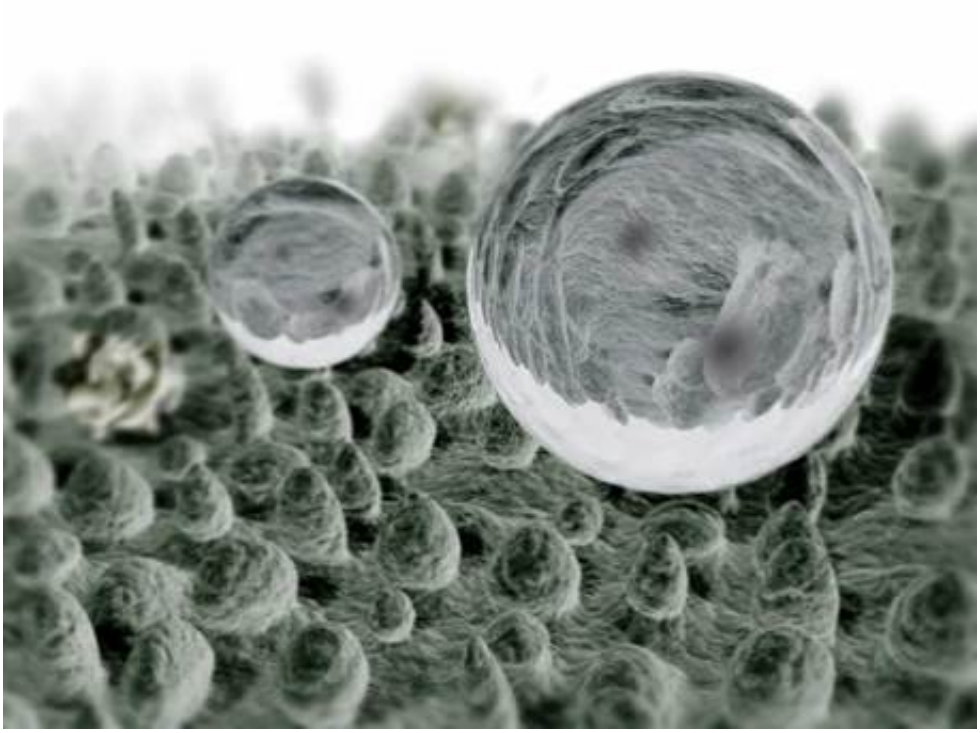


Lotus Leaf Hierarchical structures. Credit: UNIVERSITÁ DEGLI STUDI DI PARMA

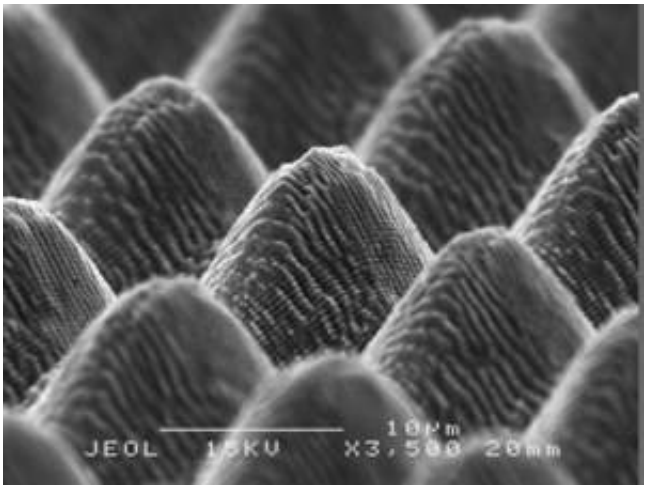
Taking their ideas from defence mechanisms found in plants such as the lotus leaf, the 'High Throughput Laser Texturing of Self-Cleaning and Antibacterial Surfaces', or 'TresClean' project, has made a breakthrough that will enable the production of self-cleaning sheet metal on an industrial scale for the first time.

This new technique will initially be used to create antibacterial surfaces for use in the food production industry – dramatically increasing productivity and reducing costs in factories which process biological food products such as milk, tomato sauce, and yoghurt.

TresClean has used high-power laser cutting devices to create a specifically tailored, rough micro-topography on sheet metal that mimics the surface of the lotus leaf, causing liquids to 'bounce off'. This roughened surface creates miniature pockets of air that minimises the contact area between the surface and a liquid.

Professor Luca Romoli, Project Coordinator of TresClean explains: "In the same way that lotus leaves keep themselves clean, without the need for cleaning products or chemicals, their jagged, rough surfaces enable water to stay as spherical droplets by preventing 'spreading'."

"Bacteria do not get a chance to stick because the contact with the metal surface and the liquid is reduced by over 80%. We are looking at an anti-bacterial metal".



Laser Induced Periodic Surface Structures (LIPSS). Credit: UNIVERSITÁ DEGLI STUDI DI PARMA

While this replicating approach may currently exist for specific and expensive plastic components, it is a first for self-cleaning metal.

Metal surfaces are textured using innovative industrial photonics devices: high-average power ultrashort-pulsed lasers are used in combination with high-performance scanning heads by utilising an innovative beam delivery method enabling movements of up to 200 m/s.

TresClean can achieve this surface texturation quickly by cutting areas of 500 square cm in less than 30 minutes. In early 2015 production methods could make laser-etched metal at a rate of 1 square inch in 1 hour, whereas TresClean can produce 1000 square cm in the same period of time, making this technology 156 times quicker than before.

Romoli estimates that TresClean could have its products ready within 2 years.

Water droplet remaining as sphere. Credit: UNIVERSITÁ DEGLI STUDI DI

PARMA

Initially aiming its product at machine parts for the food industry TresClean hopes to make a significant impact on productivity: "Vats in milk factories need to be cleaned every 6-8 hours to avoid the exponential growth of bacteria. This hinders usage and therefore affects output" Romoli said.

"By saving hours per day in cleaning, it will yield an efficiency improvement stemming from fewer sterilization cycles and less cleaning time within production as a whole. This will also reduce energy consumption as a result of fewer cleaning phases making food production quicker, safer and more profitable".

Professor Romoli sees the long-term possibilities and implications for other sectors: "It is possible that any use of metal that needs to avoid the formation of bacteria will benefit from the TresClean product, such as medical cutting tools, sterile surfaces, dishwashers, or even saucepans".

Provided by Photonics21