New paint-like coating makes tough surfaces that repel spills, scratches (w/ Video)

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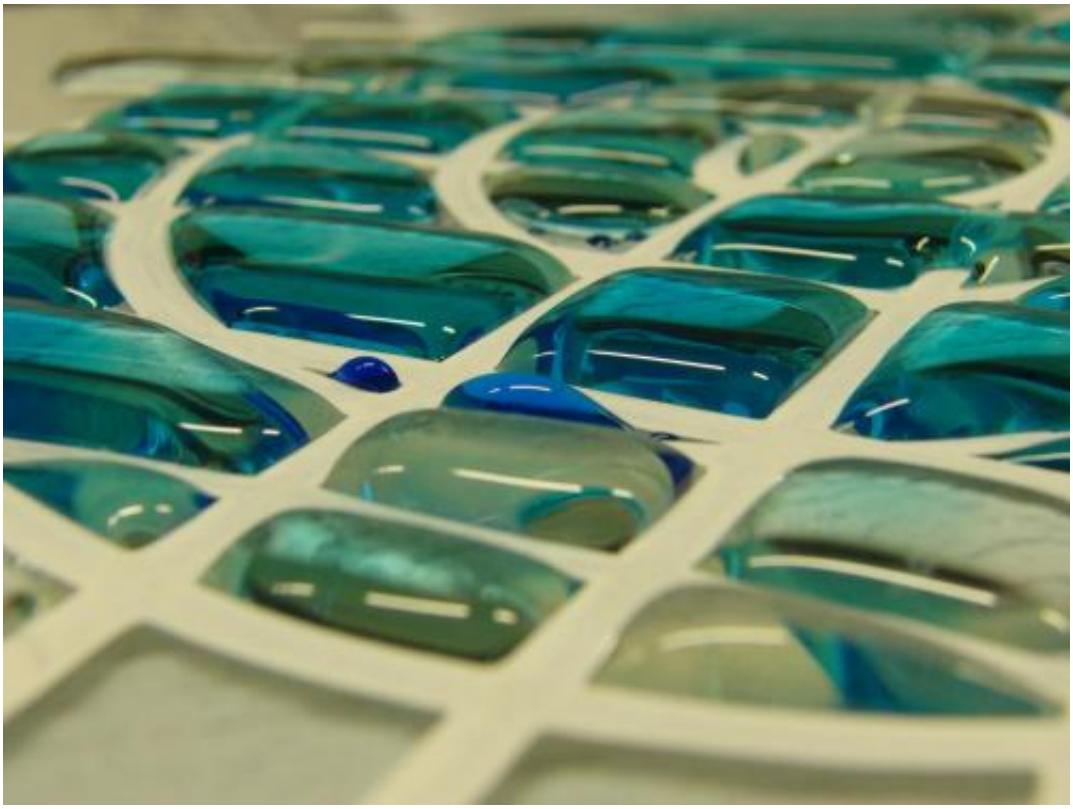


Water (dyed blue) was framed in the drawing of superhydrophobic materials, forming a 3D superhydrophobic painting. Credit: Yao Lu - UCL

A new paint that makes robust self-cleaning surfaces has been developed by a team led by UCL researchers. The coating can be applied to clothes, paper, glass and steel and when combined with adhesives, maintains its self-cleaning properties after being wiped, scratched with a knife and

scuffed with sandpaper.

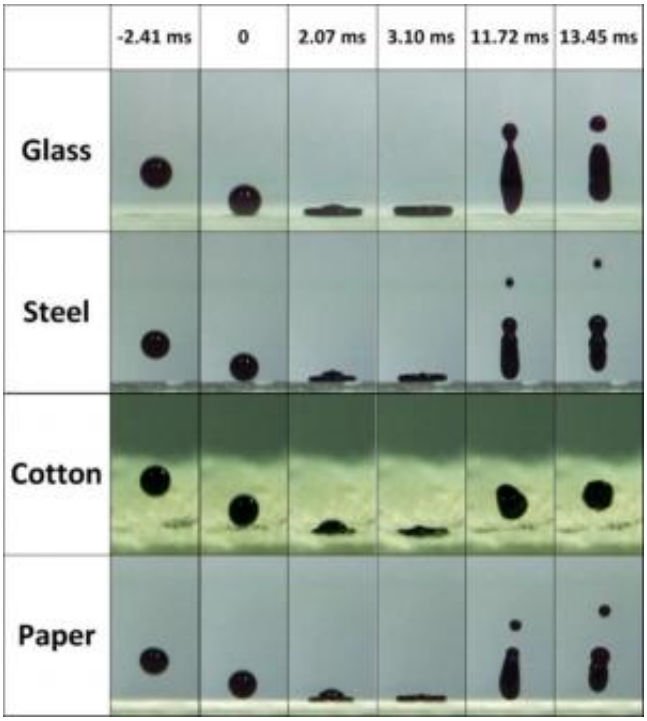
Self-cleaning surfaces work by being extremely repellent to water but often stop working when they are damaged or exposed to oil. The new paint creates a more resilient surface that is resistant to everyday wear and tear, so could be used for a wide range of real-world applications from clothing and cars, say the researchers.

First author Yao Lu (UCL Chemistry), said: "Being waterproof allows materials to self-clean as water forms marble-shaped droplets that roll over the surface, acting like miniature vacuum cleaners picking up dirt, viruses and bacteria along the way. For this to happen, the surface must be rough and waxy, so we set out to create these conditions on hard and soft surfaces by designing our own paint and combining it with different adhesives to help the surfaces withstand damage."

The study, involving researchers from UCL, Imperial College London and Dalian University of Technology (China) and published today in *Science*, shows how the new paint made from coated titanium dioxide nanoparticles can give a wide-range of materials self-cleaning properties, even during and after immersion in oil and following damage to the surface.

Different coating methods were used to create the water repellent surfaces, depending on the material. An artist's spray-gun was used to coat glass and steel, dip-coating for cotton wool and a syringe to apply the paint onto paper.

All the materials became waterproof and self-cleaning as water droplets of different sizes were seen bouncing instead of wetting the surface, removing the dirt applied by the researchers. This was maintained after damage was inflicted on the surfaces.



Time-lapse photographs of water droplets bouncing on the treated glass, steel, cotton wool and filter paper surfaces (droplet size: ca 6.3 ± 0.2 μL). Credit: Lu Yao, UCL

Mr Lu added: "Our paint worked extremely well for a variety of surfaces in tough conditions which were designed to simulate the wear and tear of materials in the real-world. For example, car paint frequently gets scuffed and scratched and we wanted to make sure our paint would survive that. As well as practical uses, the paint could also be used creatively to make art with water which is something I have been exploring in my own time."

The experiments were filmed to show the behaviour of the treated surfaces against controls. Examples include videos of treated cotton-wool being dipped into blue coloured water and emerging pristine white with no trace of contamination, and treated paper remaining dry and

clean after being exposed to dirt and water.

Co-author, Professor Claire Carmalt, who is Professor of Inorganic Chemistry at UCL Chemistry, said: "The biggest challenge for the widespread application of self-cleaning surfaces is finding a way to make them tough enough to withstand everyday damage. The surfaces tend to be mechanically weak and so rub off easily, but by pairing our paint with different adhesives, we've shown it is possible to make a robust self-cleaning surface. We used materials that are readily available so our methods can be scaled-up for industrial applications."

Corresponding author, Professor Ivan Parkin, who is Professor of Chemistry and Head of UCL Chemistry, said: "Our work aims to characterise new materials at a very small scale so we can see how best to use them to improve our daily lives. The new paint fits into a broader portfolio of surfaces we are developing for different purposes, including antimicrobial coatings to combat hospital acquired infections, and we hope its discovery advances the widespread adoption of self-cleaning surfaces."

More information: Robust self-cleaning surfaces that function when exposed to either air or oil , *Science*, www.sciencemag.org/lookup/doi/…1126/science.aaa0946

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