Scientists create clearer glass with permanent, superhydrophilic ceramic coating

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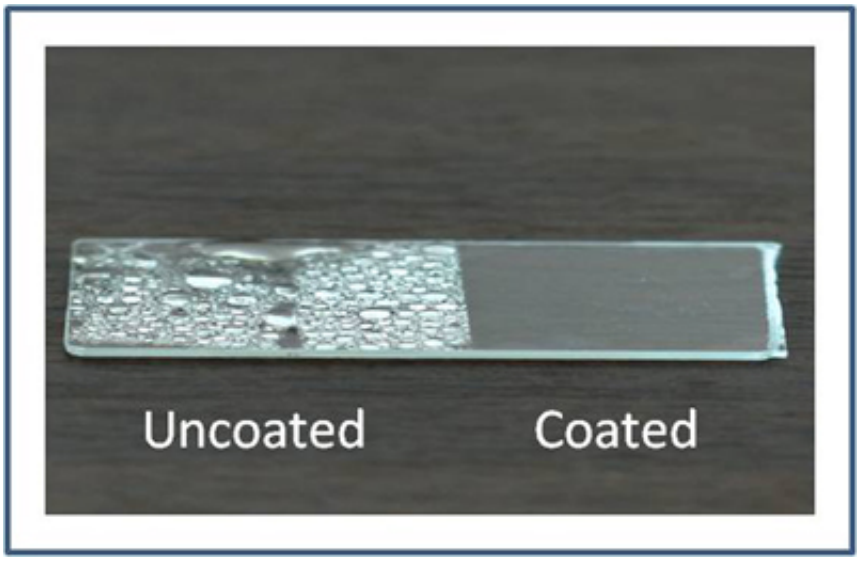

The uncoated section (left) of a glass slide is peppered with water droplets whereas the coated section (right) has a thin film of water that makes the glass clear.

When it comes to fogged up glassware or windows, the best way to keep a clear view seems to be by wiping the water droplets away constantly or having coatings that prevent the water from sticking to the glass. However, scientists at A*STAR's Institute of Materials Research and Engineering (IMRE) have discovered that doing just the opposite - collecting the water to create a uniform, thin, transparent layer - actually helps produce a better, clearer view.

IMRE has invented a new technology, CleanClear, which is a durable and permanent ceramic coating that is transparent and superhydrophilic, which means it attracts water instead of repelling it. This creates a layer of water that prevents fogging on glass or plastic surfaces, and keeps surfaces cleaner for a longer period of time. Water-forming coatings create an additional uniform water layer to produce a better view as opposed to water-repelling technologies that form water droplets which impair vision.

Reduced visibility from fogged up glass or plastic surfaces is a common problem in wet or humid environments, and affects a multitude of products such as car windshields, spectacles, goggles, and even covers for cookware. The majority of solutions rely on water-repelling coatings. Unfortunately, current coatings are not durable and most have to be re-applied regularly.

How the technology works

The new patented technology from A*STAR's IMRE is a one-time ceramic coating that can be applied onto glass or plastic materials at processing temperatures below 100oC. This is important as it makes the coating process simpler and ultimately, more cost-effective. Currently, commonly used chemical coatings degrade easily with continued usage and have to be re-applied. IMRE's new ceramic coating is durable, permanent and only needs to be applied once. Although there are also other similar "water-loving" coatings, these are often processed at much higher temperatures and can only be activated by ultraviolet (UV) rays or sunlight.

Large multinational companies also use alternative coatings like titanium dioxide (TiO2) to produce self-cleaning glass surfaces that prevent dirt and dust from sticking. However, the TiO2 ceramic coats can only be applied on surfaces during the manufacturing process at temperatures

above 600oC. This limits their application to hard materials like glass. CleanClear can be adapted to multiple surfaces and materials, ranging from glass to plastics. TiO2 coatings are also activated by sunlight but IMRE's new coating does not require activation and continues to function even at night and in low-light, indoor environments.

There are many useful applications for IMRE's "water-loving" surface. For example, it can be applied on car windshields, mirrors and motorcycle visors, allowing for better visibility in the rain. Coating building exteriors with this new material allows for self-cleaning during rain. Due to its adaptability for application on various surfaces besides glass, this could also result in potential cost savings. CleanClear can also be applied to consumer products to reduce condensation on glass covers for pots, food containers and hot food displays.

"Conventional technologies mainly use organic-based materials and some with nanoparticles but these don't last long, and need to be re-coated from time to time. The CleanClear process makes the coating part of the surface – permanently," said Dr Gregory Goh, the lead scientist from IMRE who developed the technology last year.

"CleanClear could be used to help create a sort of a clear 'vision shield' for today's car windshields during heavy rain," added Dr Goh. "Or we could use it to replace current daytime, UV light activated coatings with an all-day, all-night CleanClear coat on building facades to keep glass cleaner."

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