Nanocoating could eliminate foggy windows and lenses

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Foggy windows and lenses are a nuisance, and in the case of automobile windows, can pose a driving hazard. Now, a group of scientists at the Massachusetts Institute of Technology (MIT) may have found a permanent solution to the problem. The team has developed a unique polymer coating — made of silica nanoparticles — that they say can create surfaces that never fog.

The transparent coating can be applied to eyeglasses, camera lenses, ski goggles … even bathroom mirrors, they say. The new coating was described today at the 230th national meeting of the American Chemical Society, the world's largest scientific society.

Researchers have been developing anti-fog technology for years, but each approach has its drawbacks. Some stores carry special anti-fog sprays that help reduce fogging on the inside of car windows, but the sprays must be constantly reapplied to remain effective. Glass containing titanium dioxide also shows promise for reduced fogging, but the method only works in the presence of ultraviolet (UV) light, researchers say.

"Our coatings have the potential to provide the first permanent solution to the fogging problem," says study leader Michael Rubner, Ph.D., a materials science researcher at MIT in Cambridge, Mass. "They remain stable over long periods, don't require light to be activated and can be applied to virtually any surface." Coated glass appears clearer and allows more light to pass through than untreated glass while maintaining the

same smooth texture, he says.

The coatings consist of alternating layers of silica nanoparticles, which are basically tiny particles of glass, and a polymer called polyallylamine hydrochloride, both of which are relatively cheap to manufacture, Rubner says. He has applied for a patent on the manufacturing process and says that the coating could be available in consumer products in two to five years. The military and at least two major car manufacturers have already expressed interest in using the technology, he says.

When fogging occurs, thousands of tiny water droplets condense on glass and other surfaces. The droplets scatter light in random patterns, causing the surfaces to become translucent or foggy. This often occurs when a cold surface suddenly comes into contact with warm, moist air.

The new coating prevents this process from occurring, primarily through its super-hydrophilic, or water-loving, nature, Rubner says. The nanoparticles in the coating strongly attract the water droplets and force them to form much smaller contact angles with the surface. As a result, the droplets flatten and merge into a uniform, transparent sheet rather than forming countless individual light-scattering spheres. "The coating

basically causes water that hits the surfaces to develop a sustained sheeting effect, and that prevents fogging," Rubner says.

The same coatings also can be engineered to have superior anti-reflective properties that reduce glare and maximize the amount of light passing through, an effect that shows promise for improving materials used in greenhouses and solar cell panels, the researcher says. So far, the coating is more durable on glass than plastic surfaces, but Rubner and his associates are currently working on processes to optimize the effectiveness of the coating for all surfaces. More testing is needed, they say.

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The American Chemical Society is a nonprofit organization, chartered by the U.S. Congress, with a multidisciplinary membership of more than 158,000 chemists and chemical engineers. It publishes numerous scientific journals and databases, convenes major research conferences and provides educational, science policy and career programs in chemistry. Its main offices are in Washington, D.C., and Columbus, Ohio.

The paper on this research, PMSE 92, will be presented at 8:00 a.m., Monday, Aug. 29, at the Grand Hyatt Washington, Franklin Square room, during the symposium "Assembly of Polymers and Nanoparticles – From 2-D to 3-D."

Source: American Chemical Society (by Mark T. Sampson)