Superhydrophobic self-cleaning surfaces sound mysterious, but they work like wonders.

Water hitting the coated surfaces forms into beads on contact. The beads collect and remove dirt, dust and other stuff while rolling along, leaving behind a clean surface.

"It's the same procedure that a lotus leaf uses to clean itself out in the open," said Constantine Megaridis, professor of mechanical and industrial engineering.

He and his Micro/Nanoscale Fluid Transport Laboratory students have developed a patent-pending process that may lead to new uses for these special coatings in a wide range of products.

"We take commercially available chemicals and process them using a proprietary method," Megaridis explained.

"The primary chemicals we use, after mixing, react quickly, forming a solid. Our method allows these mixed chemicals to maintain a liquid form, making it possible to put it in a sprayer or other coating application. It's like paint.

"You dissolve the polymer in a solvent and it becomes a liquid, which you can 'paint' on to a surface," he said.

"We add adhesion promoters — which make it sticky — along with other particles and materials that impart different functionalities."

While there are many protective polymer coatings now on the market, they often have poor surface adhesion and scratch or wear off, which limits effectiveness.

A broad range of surfaces can be coated with the Megaridis lab process, from glass and metal to fabrics and rubber. The coating ingredients they
use are inexpensive, and Megaridis’ unique chemistry process makes application easy, quick-drying and provides greater durability for use in a variety of environmental conditions — such as coatings subjected to outdoor temperature extremes.

“The ability to make coatings out of ingredients that have different functionalities is what’s unique about what we do,” he said.

Work began on these nanocomposite coatings about two years ago when Megaridis’ former student Ilker Bayer (‘06 Ph.D., mechanical and industrial engineering) started collaborating with another of his former Ph.D. students, Manish Tiwari, now a post-doctoral researcher at ETH-Zurich, the Swiss Federal Institute of Technology.

Bayer, currently a research scientist in aerospace engineering at UIUC, still works with the UIC group and with UIUC aerospace engineering professor Eric Loth on developing self-cleaning surface coatings that repel both water and oils.

Megaridis said that while his lab’s work attracts customers and inquiries from top industries, there’s still much to be done to improve durability for various applications.

Key potential high-end applications of such self-cleaning coatings include aerospace, shipping, electronics, medical implants, building and home windows and siding.

Car windshields are good prospects too, said Megaridis.

“If you have the ability to create self-cleaning surfaces, after each time it rains your windshield would be very clean.”

Other project researchers include Ph.D. students Arindam Das and Tom Schutzius and research professor Gregory Jursich.

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