Ultrathin films promise a multitude of uses

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Imagine a special coating that can be applied to any of a number of surfaces. With its application, carpets, furniture and clothing become super-resistant to stains; automobile bodies are impermeable to water and rust; stents put in place during heart surgery no longer are susceptible to tissue growth that can restrict blood flow; and cell cultures are more easily produced in the laboratory.

These are just a few of the possibilities envisioned by a Florida State University researcher who is developing processes for applying such coatings.

Joseph B. Schlenoff, a professor in FSU's department of chemistry and biochemistry and associate director of its Center for Materials Research and Technology (MARTECH), has worked for more than eight years to develop ultrathin films that repel water and other corrosive substances.

"When you wax your car, water tends to bead up on the surface in small droplets," Schlenoff said. "But when one of these films is applied, water virtually flies off. That's because the films are 'superhydrophobic,' and water droplets ride over them."

The key to creating such films lies in a layering process that Schlenoff has patented.

"Essentially, we place layers of positively and negatively charged electrolytes atop one another," he said. "Their electrical charges cancel each other out, creating a neutrally charged, ultrathin film. The

protective seal that is created by such films is much more effective than paints or resins alone at repelling corrosive substances, such as salt or water."

Naresh Dalal, chairman of FSU's department of chemistry and biochemistry, said that other researchers have created methods for producing multilayer films, but that Schlenoff's process is particularly simple -- and relatively inexpensive to reproduce. "The potential applications for this technology are staggering," he said.

Consider these possibilities:

-- Car bodies, building materials, boat hulls or other items that are likely to degrade when exposed to the elements could be treated with ultrathin films during the manufacturing process to make them resistant to rust, corrosion or water damage.

-- Stains on clothing, carpeting and other fabrics could be a thing of the past if films are applied.

-- Stents used for implantation inside coronary arteries during surgical procedures could be coated with an ultrathin film that prevents cells and proteins from adhering, thus avoiding a narrowing of the arteries and restriction of blood flow.

-- Contact lenses could be treated to prevent proteins and calcium deposits from binding to them during wear.

-- High-speed electronics could be coated with ultrathin films to make them resistant to electrostatic fields that interfere with their functions.

-- Glass slides can be stamped with films that encourage or retard cellular adhesion in certain areas, allowing for greater efficiency in

producing certain cell cultures used in biomedical research.

Already, one of Schlenoff's patents has entered the marketplace. Recently, Schlenoff and another FSU researcher, Stephen Dubas, designed a small robot that can dip glass slides into beakers to coat the slides with an ultrathin film. Copies of the robot are selling all over the world for more than $10,000 apiece.

All told, Schlenoff holds six issued U.S. patents, with several pending, related to ultrathin films, placing him second among FSU faculty behind fellow chemistry Professor Robert Holton, whose discovery of a synthetic form of the cancer-fighting drug Taxol earned the university $67 million a year at the peak of its popularity.

"It's exciting to be involved in an emerging technology that has potential for helping people in so many ways," Schlenoff said. "If it benefits FSU financially, all the better."

Source: Florida State University