MATERIALS

Smudge-Free Surfaces

A coating based on candle soot sheds oil and water

SOURCE: "CANDLE SOOT AS A TEMPLATE FOR A TRANSPARENT ROBUST SUPERAMPHIPHOBIC COATING"
Doris Vollmer et al.
Science 335: 67–70

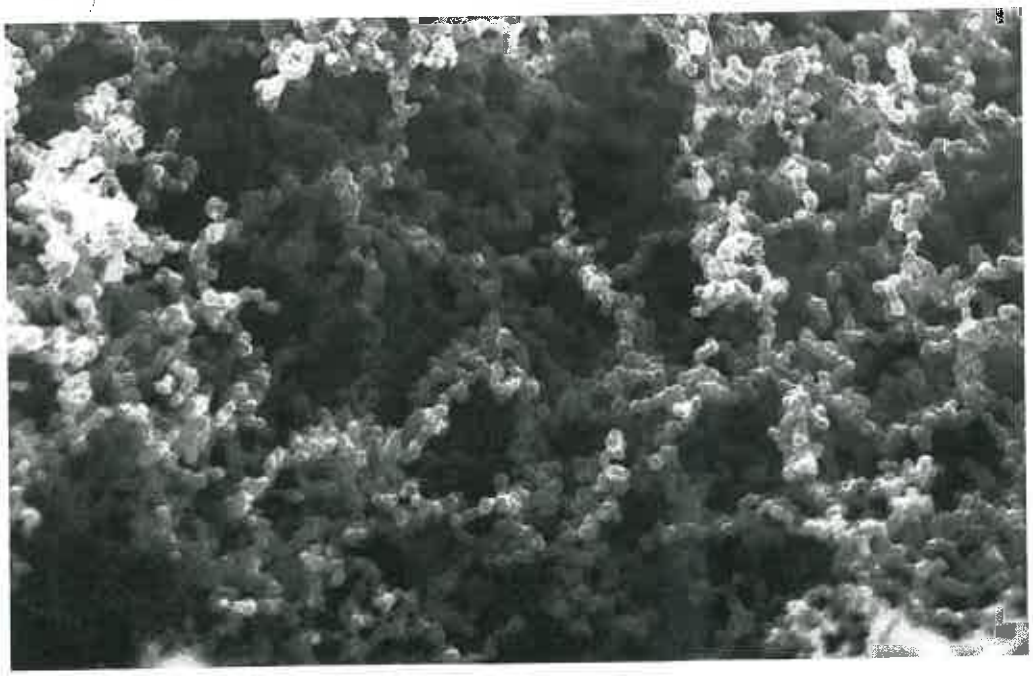
RESULTS: A coating made of soot and silica repels both oil and water from glass and metal surfaces.

WHY IT MATTERS: Eyeglasses, smart phones, medical devices, and the insides of gas turbines can all benefit from coatings that keep oil and other liquids from sticking to them. Researchers know what sorts of microscopic structures on a surface will repel oil, but the techniques used to make them have typically been too expensive for widespread commercial application. The new technique could prove much cheaper: it uses particles of soot as a template for the structures, so they don't have to be carved using a process such as photolithography.

METHODS: The researchers held a glass slide over a candle flame to coat it with soot made of nanoscale spheres that stack up, resulting in a texture that repels oil. They covered the soot with a layer of silica to keep it from washing away. Then they baked the slide at 600 °C, which rendered the soot transparent.

NEXT STEPS: Applying soot is cheap, but the method the researchers used for applying the silica is relatively expensive. They're testing cheaper techniques.

SOOT PARTICLES The microscopic structure of a layer of soot, shown here in an image from an electron microscope, provides a template for a new oil-repelling coating.



SCIENCE / DORIS VOLLMER

ENERGY

Sunlight Absorber

A nanoscale pattern could lead to more efficient solar cells

SOURCE: "BROADBAND POLARIZATION-INDEPENDENT RESONANT LIGHT ABSORPTION USING ULTRATHIN PLASMONIC SUPERABSORBERS"
Harry Atwater et al.
Nature Communications 2: 517

RESULTS: Thin films of silver ordinarily absorb only 5 percent of visible light. By applying a pattern of nanoscale shapes to such a surface, researchers increased absorption to 70 percent. The patterned film absorbs light from the entire visible spectrum and from almost any angle.

WHY IT MATTERS: The advance could lead to solar cells that are far thinner and cheaper than conventional ones, because less semiconductor material would be needed to absorb sunlight. Researchers have known that nanoscale patterns can greatly enhance light absorption by gathering light waves the way antennas gather radio waves. But these patterns typically absorb only light of certain wavelengths, allowing most of the solar spectrum to escape. That makes them impractical for use in solar cells. The researchers have demonstrated that their patterns can be used to absorb a wide range of wavelengths, opening the door for their use in photovoltaic devices.

METHODS: The researchers used lithography to carve patterns of tiny wedge shapes placed end to end. The narrow end of the wedges can absorb short wavelengths at the blue end of the spectrum, and the wider end absorbs longer-wavelength red light.

NEXT STEPS: The researchers are working to apply the nanoscale design to materials used in solar cells. In recent, unpublished experiments, they showed that the patterns can allow thin films of silicon to absorb as much light as unpatterned silicon films 25 times as thick. tr