Such antireflective nanotexturing is found in moth eyes and cicada wings. Researchers have tried to mimic such nanostructures with mixed success.

Black and his colleagues used block copolymers in their approach, as described in an article published in a recent issue of *Applied Physics Letters* (doi:10.1063/1.5000965). They first made a template with the block copolymer polystyrene-*b*-poly(methyl methacrylate), which self-assembles into a periodic pattern. They then used plasma etching to transfer this pattern to a glass surface. They placed the template on a glass surface, and a hot plasma gas etched out the tiny areas that were not protected by the template. This left the glass surface covered with densely packed cone-shaped structures that were less than 10 nm in width.

Covering both surfaces of the glass with 280-nm-tall nanocones reduced the reflections of all visible and near-infrared wavelengths to less than 0.2%. Taller nanocones made the glass surface more antireflective, the researchers found.

Black's research team has used a similar technique before to create nanotextures on silicon to increase light absorption in solar cells. The textured surface should stay dust-free since the space between the cones is too tiny for dust particles, which are typically tens of micrometers in size.

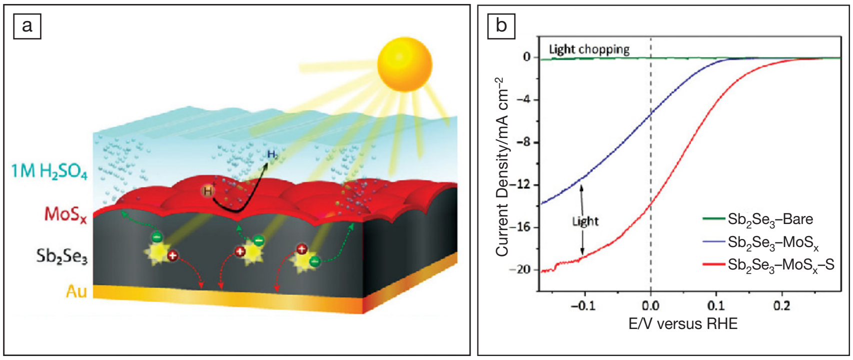
The techniques are compatible with industrial processes used for microelectronics and displays, says Black, which makes them amenable to being made practical. The researchers now need to investigate whether the nanostructured glass will be robust and economical enough for commercial use.

Prachi Patel

Energy Focus

Earth-abundant photocorrosion-resistant material used for solar water splitting

A simple and low-temperature antimony (Sb) deposition method has been used to generate a new photocorrosion-resistant material for water-splitting applications. Research led by David Tilley of the University of Zürich made the conventional protective layer in a solar water-splitting application an obsolete requirement by introducing a combination of Sb_2Se_3 and MoS_x, which functions without the need of any protective layer. Their research was published in a recent issue of the *Journal of Materials Chemistry A* (doi:10.1039/c7ta08993g).



(a) Schematic representation of Sb_2Se_3–MoS_x photocathode. (b) Current density-potential characteristics of Sb_2Se_3–MoS_x (non-sulfurized) and Sb_2Se_3–MoS_x–S (sulfurized) photocathode in 1 M H_2SO_4 under simulated 1 sun illumination (100 mW cm^{-2}). The bare Sb_2Se_3 is under light chopping (i.e., light was blocked as the device was measured under dark conditions). Reproduced from *J. Mater. Chem. A* **5** (2017), p. 23139, with permission from the Royal Society of Chemistry.

The Sb_2Se_3 thin films were fabricated through selenization of simple, low-temperature electrodeposited Sb films. Current state-of-the-art photocathodes need a protective layer of titanium dioxide (TiO_2). Initially, Tilley's group used Sb_2Se_3 with the TiO_2 protective layer and a platinum (Pt) catalyst. However, they soon realized the stable nature of Sb_2Se_3 and found low-cost amorphous MoS_x to replace scarce and expensive Pt.

Tilley says, "We considered that the Sb_2Se_3 might be stable without protective layers, and we also wanted to explore earth-abundant alternatives to state-of-the-art HER catalysts like Pt and RuO_x. One such candidate which came to our mind was amorphous MoS_x as it could be prepared by a simple electrodeposition method which was low cost and fast." The photocorrosion-resistant behavior of Sb_2Se_3 in combination with MoS_x eliminates the need for any such coating. Sb_2Se_3–MoS_x is one of the few materials that is immune to photocorrosion while providing the high photocurrent that is required for water-splitting applications.

A sulfurization process became the key factor in increasing the photocurrent of the device. A high photocurrent density of 5.2 and 13 mA cm^{-2} at 0 V versus RHE was recorded for Sb_2Se_3–MoS_x and Sb_2Se_3–MoS_x–S (sulfurized photocathode coupled with the catalyst), respectively. The sulfurization only affects the surface of the MoS_x layer as indicated in elemental mapping performed through energy-dispersive x-ray spectroscopy.

Kazuhiro Takanabe of the Physical Science and Engineering Division at King Abdullah University of Science and Technology (KAUST), highlights the importance of this publication in the field of solar water splitting. "Chalcogenide semiconductors have been long considered as photoelectrochemical material, but its stability in water under illumination remains an issue. Ramanujam et al. (this study) exhibited a way of the successful decoration of Sb_2Se_3 with a hydrogen evolution catalyst (MoS_x) to solve the photocorrosion path. This methodology can be applied to various materials, and thus it is an important finding," Takanabe says.

Tilley and his research team are now looking to gain a deeper understanding of recombination mechanisms in the Sb_2Se_3–MoS_x–S photocathode to increase the photovoltage.

Rahim Munir