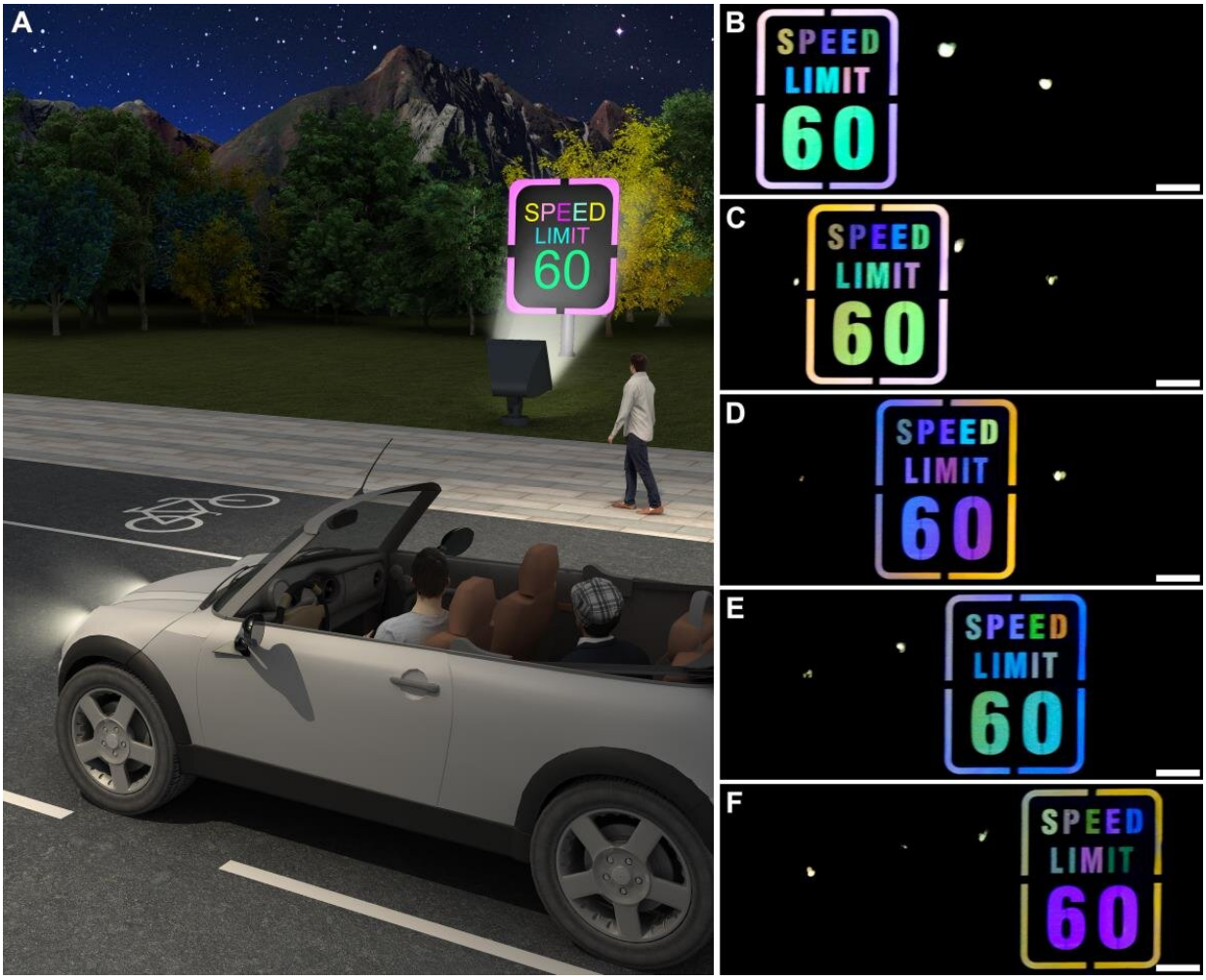
New retroreflective material could be used in nighttime color-changing road signs

August 9 2019



An image series shows how a new retroreflective material can be used to make a color-changing speed limit sign. Boxes A-F show how the sign changes color, from the perspective of drivers on the road, as they pass by. Credit: Fan et al., *Sci. Adv.* 2019; 5 : eaaw8755. CC BY-NC

A thin film that reflects light in intriguing ways could be used to make road signs that shine brightly and change color at night, according to a study that will be published on Aug. 9 in *Science Advances*.

The technology could help call attention to important traffic information when it's dark, with potential benefits for both drivers and pedestrians, researchers say.

The film consists of polymer microspheres laid down on the sticky side of a transparent tape. The material's physical structure leads to an interesting phenomenon: When white light shines on the film at night, some observers will see a single, stable color reflected back, while others will see changing colors. It all depends on the angle of observation and whether the light source is moving.

The research was led by Limin Wu, Ph.D., at Fudan University in China, whose group developed the material. Experts on optics at the University at Buffalo made significant contributions to the work, providing insight into potential applications for the film, such as employing it in nighttime road signs.

"You can use this material to make smart traffic signs," says Qiaoqiang Gan, Ph.D., an associate professor of electrical engineering in the UB School of Engineering and Applied Sciences and a co-first author of the new study. "If a person is listening to loud music or isn't paying attention while they're walking or driving, a color-changing sign can help to better alert them to the traffic situation."

Testing color-changing road signs at night

In one set of experiments, researchers created a speed limit sign with

letters and numbers made from the new film. The scientists placed a white light nearby to illuminate the sign, and when a fast-moving car drove past, the color of the characters on the sign appeared to flicker from the perspective of the driver as the driver's viewing angle changed.

In other tests, the team applied the new material to a series of markers lining the side of a road, denoting the boundary of the driving lane. As a car approached, the markers lit up in bright colors, reflecting light from the vehicle's headlights.

From the driver's perspective, the markers' color remained stable. But to a pedestrian standing at the side of the road, the color of the markers appeared to flicker as the car and its headlights sped past.

"If the car goes faster, the pedestrian will see the color change more quickly, so the sign tells you a lot about what is going on," says co-author Haomin Song, Ph.D., UB assistant professor of research in electrical engineering.

More information: "Iridescence-controlled and flexibly tunable retroreflective structural color film for smart displays," *Science Advances* (2019). DOI: 10.1126/sciadv.aaw8755

Provided by University at Buffalo