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Abstract: The article examines how chemists in England have created a window coating that automatically transforms into a heat mirror only when warmed above room temperature. The material is made of vanadium dioxide imbued with traces of tungsten. Compared with clear glass, the film in its heat-reflecting state could reduce by up to half the amount of room heating due to infrared radiation. What's different in the current work is the coating method, which promises to be the first that's compatible with large-scale commercial-glass production. Previous coating schemes have required new-made glass to be cooled completely and then put under special conditions, such as a vacuum. Despite the new film's attractions, difficulties remain. Among them, the coating is an unsightly yellow-green. Also, it rubs off when subjected to vigorous wiping. Those flaws can probably be overcome by adding blue dyes to the coating and sandwiching it within double-paned glass.

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Warm Reflections

Window tint kicks in when it's hot

Some window coatings reflect heat. Unfortunately, they also keep out the sun's warmth when outside temperatures are chilly. Now, chemists in England have created a window coating that automatically transforms into a heat mirror only when warmed above room temperature. The material is made of vanadium dioxide imbued with traces of tungsten.

Compared with clear glass, the film in its heat-reflecting state could reduce by up to half the amount of room heating due to infrared radiation, estimates Ivan P. Parkin of the University College London. He and Troy D. Manning of Liverpool University in England describe their new coating in the Aug. 11 Journal of Materials Chemistry.

Existing heat-reflecting coatings "are passive and will not change with the environmental conditions," notes Simon J. Hurst of the Lathom, England-based laboratory of the giant British glassmaking firm Pilkington. Although Pilkington didn't formally participate in the new research, the firm has collaborated with Parkin's lab.

"The development of a smart coating that changes properties according to an external stimulus is of great interest," Hurst adds. Still, the extra cost of the new "thermochromic" coating mustn't outweigh its heat-blocking benefits, he notes. The technology must also compete with switchable electrochromic films, which respond to an electric voltage that can be triggered by a heat sensor (SN: 5/15/99, p. 314).

Decades ago, materials scientists discovered that heating vanadium dioxide above 68°C transforms it from a semiconductor that lets heat rays through to a more metallic substance that reflects them. More recently, experimenters found that adding some tungsten to the compound could drive down the transition temperature. Indeed, some experimenters made films that switch states near room temperature, as the new one does. It changes at 29°C.

What's different in the current work is the coating method, which promises to be the first that's compatible with large-scale commercial-glass production. Previous coating schemes have required new-made glass to be cooled completely and then put under special conditions, such as a vacuum.

Manning and Parkin have demonstrated a laboratory version of a process in which newly made glass, still at 550°C, is exposed at atmospheric pressure to steam combined with two gases: vanadium oxytrichloride and tungsten hexachloride. The vapors adsorb onto the glass surface and react chemically there to form a coating less than a hundredth the thickness of a human hair.

Despite the new film's attractions, difficulties remain. Among them, the coating is an unsightly yellow-green. Also, it rubs off when subjected to vigorous wiping. Those flaws can probably be overcome by adding blue dyes to the coating and sandwiching it within double-paned glass, the researchers say.

PHOTO (BLACK & WHITE): FICKLE FINGERS. Above room temperature, this carpet of tungsten-tinged vanadium dioxide projections reflects heat rays away from a glass surface. Scale bar at right: 1 micrometer.

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By Peter Weiss

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