New nanophotonic coating could aid thermal management and counter-surveillance efforts

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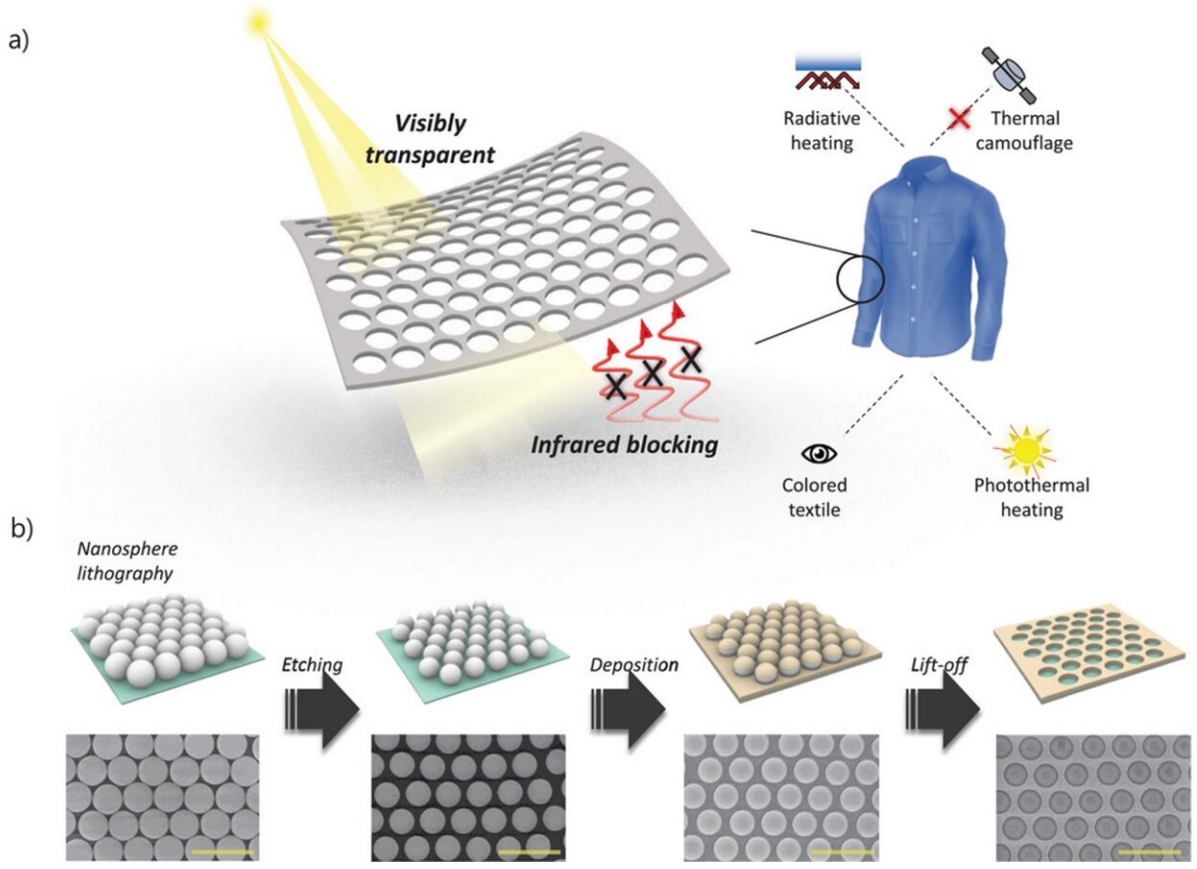

a) Schematic of the VTIR to block the emission of thermal radiation for radiative heating and thermal camouflage. b) Schematic of the fabrication process and SEM images for VTIR coatings. Scale bar, 2 μm. Credit: The Grainger College of Engineering, University of Illinois Urbana-Champaign

Controlling thermal radiation is crucial in various industries and applications. In particular, infrared emissions from the body are important since body temperature can be regulated without the use of external energy sources (i.e. heater and air conditioner).

Previous studies have shown that when materials which reflect radiation from the body are worn, the wearer's body temperature increases. However, the majority of these materials are metal with a distinctive color, making it challenging to use textiles in other colors. Additionally, they reflect most solar light, which makes the absorption of sunlight for outside warming difficult.

To address these problems, University of Illinois Urbana-Champaign Professor Lili Cai and her team recently devised a visibly transparent infrared reflective coating.

Designed with a nano-mesh structure, their new coating sufficiently transmitted visible light—including sunlight—and reflected body thermal radiation like conventional metal-based textiles. They were also able to utilize various colors of textile to achieve a warming effect without energy consumption.

In addition, by combining their nano-pore structure with a photothermal material, the researchers were able to confine both sunlight and thermal energy from the body inside the textile. Even in freezing weather, their coating achieved a 15°C (59°F) higher heating effect than commercial clothing—which could allow more outdoor activity during the winter months without the need for bulky clothing.

Applications for this technology go beyond personal heat management, however. The reflective properties of the team's newly developed coating can be used in counter-surveillance military applications —specifically, to provide camouflage under the scrutiny of thermal

imaging cameras. Their tests of the thermal camouflage effect, at temperatures ranging from 34° to 250°C (93° to 482°F) were so promising that it could successfully be used for both daytime and nighttime cloaking.

The research is published in *Advanced Functional Materials*.

More information: Ho Kun Woo et al, Visibly Transparent and Infrared Reflective Coatings for Personal Thermal Management and Thermal Camouflage, *Advanced Functional Materials* (2022). DOI: 10.1002/adfm.202201432

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