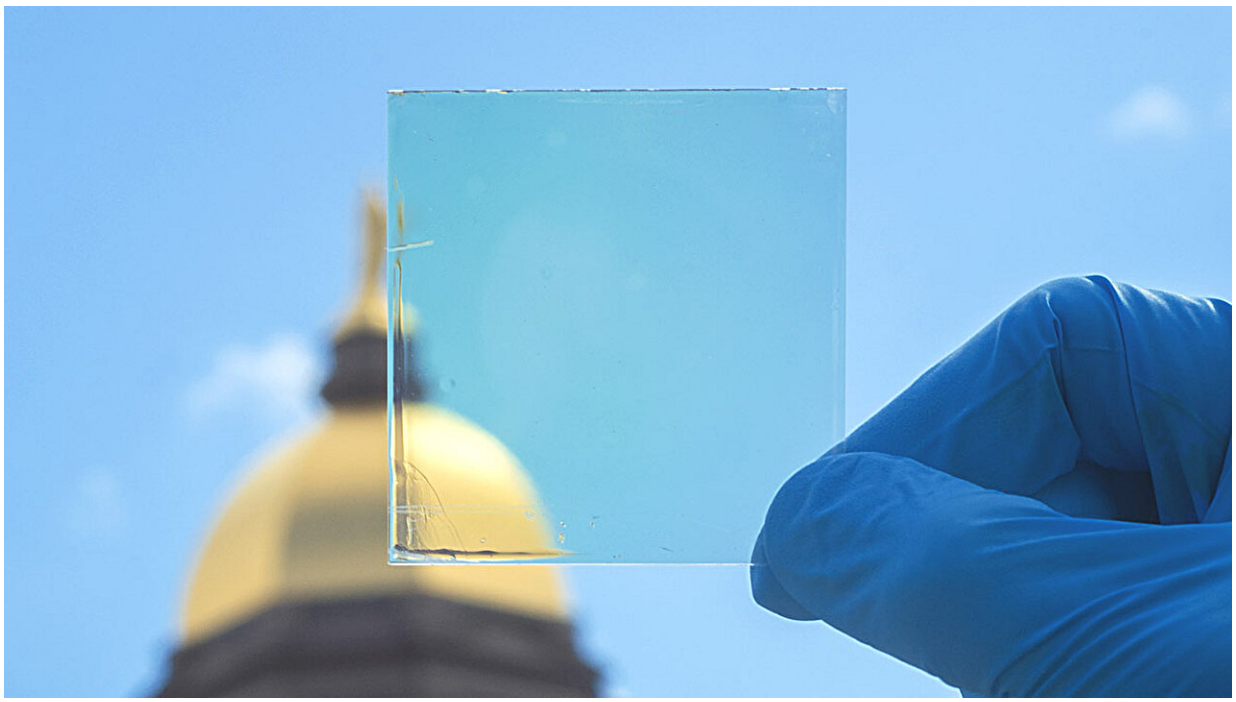
# Sunrise to sunset, a new window coating blocks heat, not view

April 2 2024, by Karla Cruise



Researchers at the University of Notre Dame have developed a new window coating to block heat-generating ultraviolet and infrared light and allow for visible light, regardless of the sun's angle. Credit: University of Notre Dame

Windows welcome light into interior spaces, but they also bring in unwanted heat. A new window coating blocks heat-generating ultraviolet and infrared light and lets through visible light, regardless of the sun's angle. The coating can be incorporated onto existing windows or automobiles and can reduce air-conditioning cooling costs by more than one-third in hot climates.

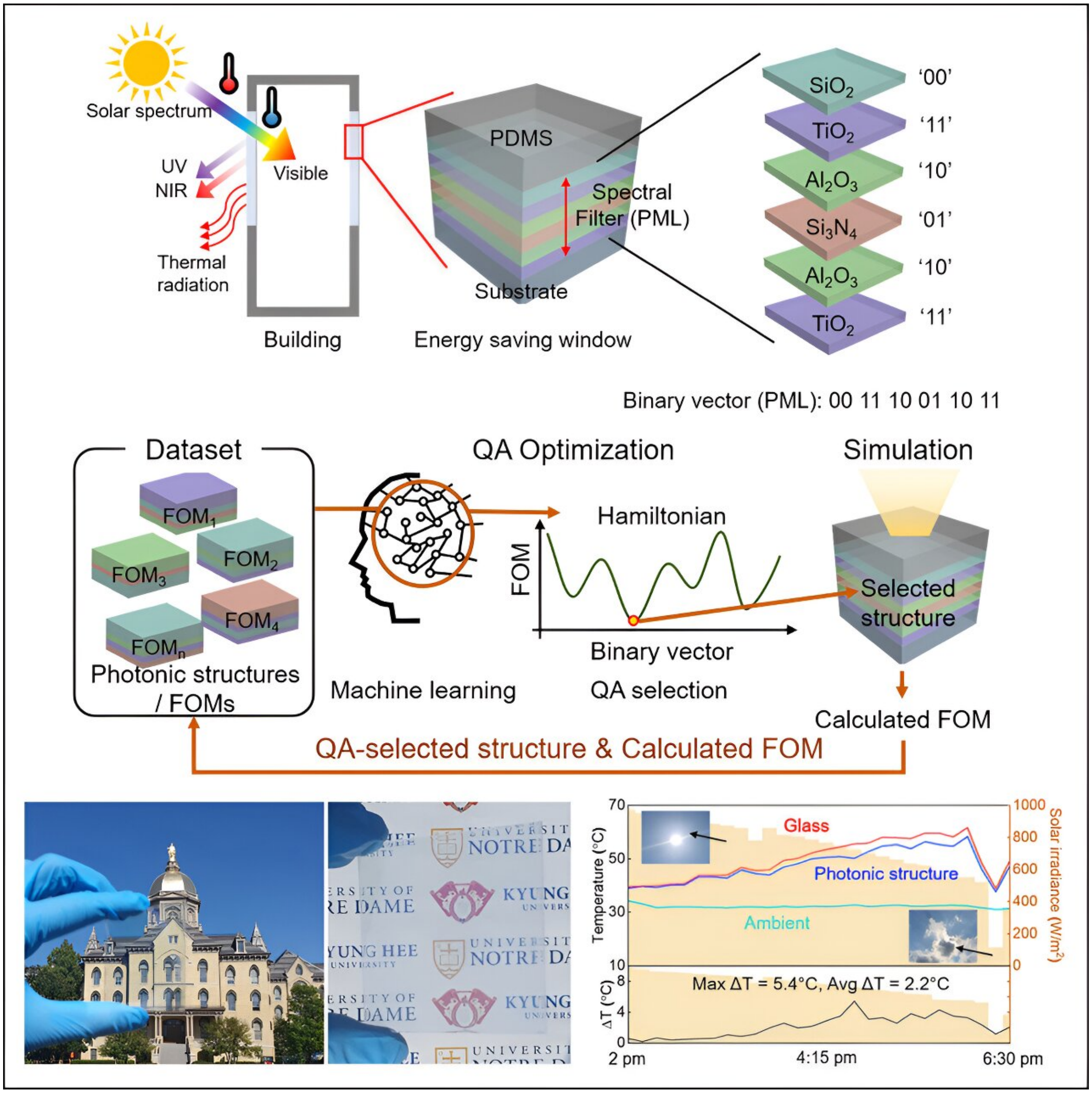
"The angle between the sunshine and your window is always changing," said Tengfei Luo, the Dorini Family Professor for Energy Studies at the University of Notre Dame and the lead of the study. "Our coating maintains functionality and efficiency whatever the sun's position in the sky."

The research is published in the journal *Cell Reports Physical Science*.

Window coatings used in many recent studies are optimized for light that enters a room at a 90-degree angle. Yet at noon, often the hottest time of the day, the sun's rays enter vertically installed windows at oblique angles.

Luo and his postdoctoral associate Seongmin Kim previously fabricated a transparent window coating by stacking ultra-thin layers of silica, alumina and titanium oxide on a glass base. A micrometer-thick silicon polymer was added to enhance the structure's cooling power by reflecting thermal radiation through the atmospheric window and into outer space.

Additional optimization of the order of the layers was necessary to ensure the coating would accommodate multiple angles of solar light. However, a trial-and-error approach was not practical, given the immense number of possible combinations, Luo said.




Graphical abstract. Credit: *Cell Reports Physical Science* (2024). DOI: 10.1016/j.xcrp.2024.101847

To shuffle the layers into an optimal configuration—one that maximized the transmission of visible light while minimizing the passage of heat-producing wavelengths—the team used quantum computing, or more specifically, quantum annealing, and validated their results experimentally.

Their model produced a coating that both maintained transparency and reduced temperature by 5.4 to 7.2 degrees Celsius (about 9.7 to 13 degrees Fahrenheit) in a model room, even when light was transmitted in a broad range of angles.

"Like polarized sunglasses, our coating lessens the intensity of incoming light, but unlike sunglasses, our coating remains clear and effective even when you tilt it at different angles," Luo said.

The active learning and quantum computing scheme developed to create this coating can be used to design of a broad range of materials with complex properties.

**More information:** Seongmin Kim et al, Wide-angle spectral filter for energy-saving windows designed by quantum annealing-enhanced active learning, *Cell Reports Physical Science* (2024). DOI: 10.1016/j.xcrp.2024.101847

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