Team develops see-through aerogel made from wood that better insulates double-paned windows

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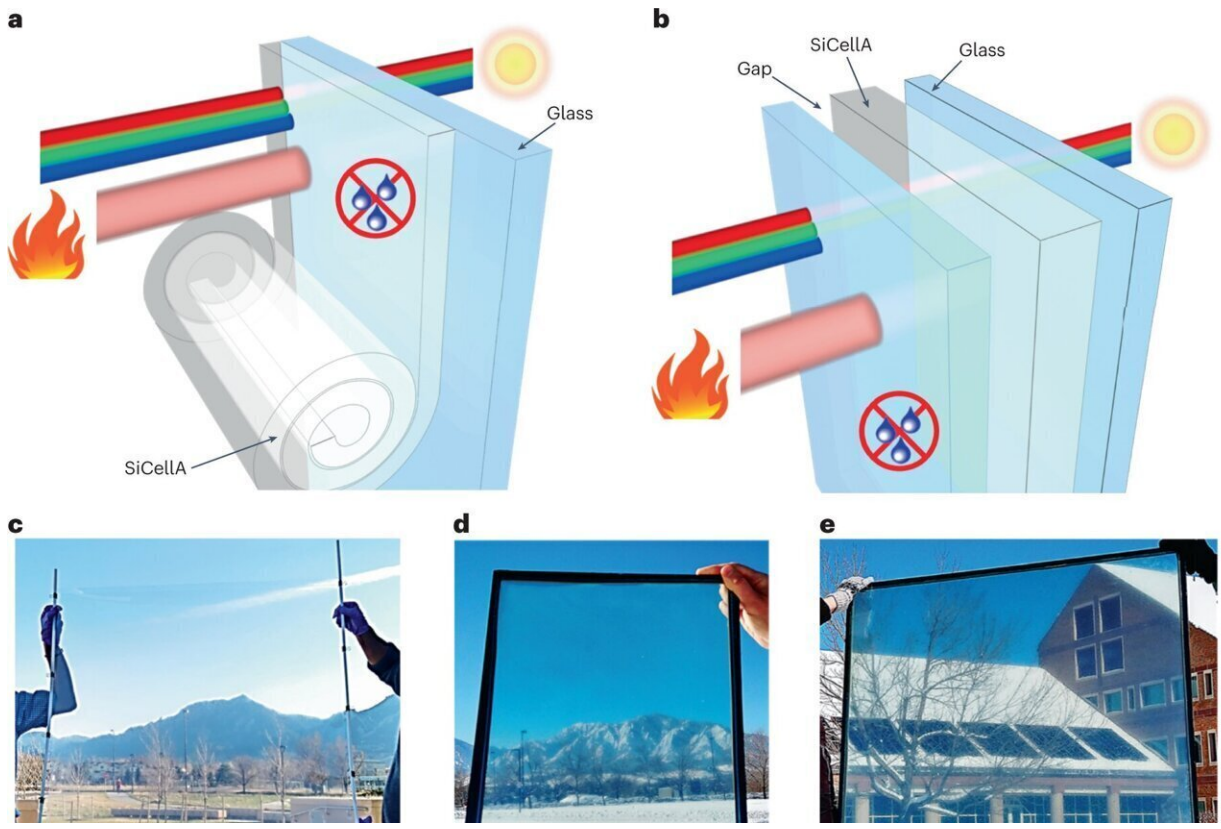

SiCellA-based window retrofits and IGUs. **a**,**b**, Schematic drawings of a window retrofitted with a SiCellA film (**a**) and an IGU with a SiCellA film inserted between glass panes (**b**). Schematics depict how window products can be used to boost thermal insulation and condensation resistance while maintaining visible-range transparency. **c**, Square-meter, 1.5 mm-thick SiCellA with 99.2% porosity adhered to an optically clear plastic film. **d**,**e**, Photos of 36 cm × 51 cm (**d**) and

square-meter (**e**) double-pane IGUs with LoĒ-366 coatings on one glass pane and 3 mm-thick SiCellA films attached to a surface of the other glass panes. Note that the slight coloring in **d** and **e** comes from the LoĒ-366 coated glass used in these IGUs. **f**, Single-pane window retrofitted with a 72.1 cm × 71.4 cm SiCellA 1.5 mm-thick film (indicated by a white arrow and outlined by a dashed line) and photographed from outside with both a regular photo camera (left) and a thermal imaging camera (right) in a building on the University of Colorado campus. Temperature is coded according to a color scale. **g**,**h**, Infrared thermal imaging photos of different types of fenestration mounted in the openings of 0.78 m × 0.68 m × 0.43 m hot (**g**) or cold (**h**) boxes with the inside temperature set at 40 °C (**g**) and −20 °C (**h**). 'SiCellA-IGU' marks a double-pane IGU with a SiCellA aerogel film; 'IGU' marks a double-pane IGU without SiCellA; 'Retrofit' marks a single 3 mm-thick glass pane retrofitted with a SiCellA film; 'Single pane' marks a single 3 mm-thick glass pane. Credit: *Nature Energy* (2023). DOI: 10.1038/s41560-023-01226-7

A team of physicists and material scientists at the University of Colorado has developed a way to better insulate double-paned glass used for windows by adding a transparent aerogel. In their paper published in the journal *Nature Energy* the group describes how their aerogel is made and how much of a boost in energy efficiency can be expected from windows using the material. *Nature Energy* has also published a Research Briefing in the same journal issue that outlines the work done by the team.

Since most homeowners prefer to have windows that allow them to see outside, heat loss is inevitable. Over the past several decades, heat loss from windows has been improved by adding a second pane of glass—the two panes are typically separated by a gap of insulating air. Still, such windows do not provide nearly the same degree of insulation as insulated walls. In this new approach, the team in Colorado has come up with a way to improve the insulation properties of double-paned glass.

To make the aerogel (a gel with pockets of air in it), the research team soaked nanofibers of cellulose extracted from wood in water. Next, the wood nanofibers were removed and were then dunked in an ethanol solution. Once saturated, the nanofibers were heated in a pressurized oven—this forced the ethanol pockets to be replaced with air. Next, the nanofibers, which were transparent, were coated with a water-repellent material to prevent condensation when situated between panes of glass.

The finished product filled the space between panes of glass. The researchers note that in addition to providing more insulation, the new approach allows for increasing the distance between panes, adding even more insulation. Testing showed that a gap of 2.5 centimeters provided the same degree of insulation as an insulated wall.

The research team also points out that testing showed the aerogel to have a visible-range light transmission of 97%–99%, which they note is better than glass. It also had a haze factor of less than 1%.

More information: Eldho Abraham et al, Highly transparent silanized cellulose aerogels for boosting energy efficiency of glazing in buildings, *Nature Energy* (2023). DOI: 10.1038/s41560-023-01226-7

Transparent aerogels reduce energy loss through building windows, *Nature Energy* (2023). DOI: 10.1038/s41560-023-01229-4

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