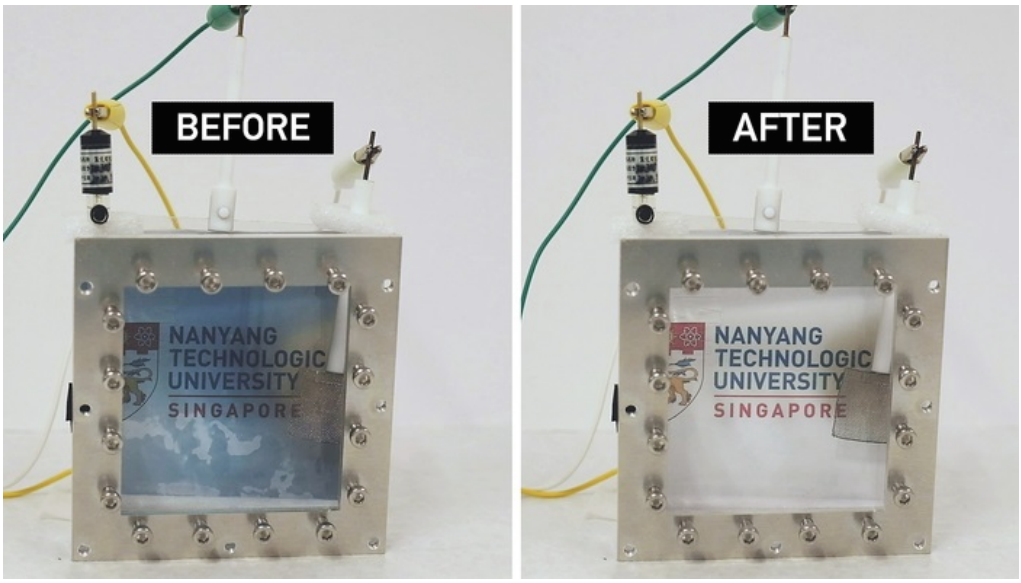
Science & Technology

New smart window material can block rays without blocking the view

henryhendricks • 12 hours ago



A new energy-saving material for electrochromic (EC) windows blocks light rays without compromising visibility through the window. Credit: NTU Singapore.

Scientists have invented “smart” windowing materials that control heat transfer without obstructing visibility, helping to reduce the energy required to heat and cool buildings.

Developed by NTU researchers, a new energy-saving material for electrochromic (EC) windows that operates at the push of a switch is designed to block infrared rays, the main component of heat-emitting sunlight. ..

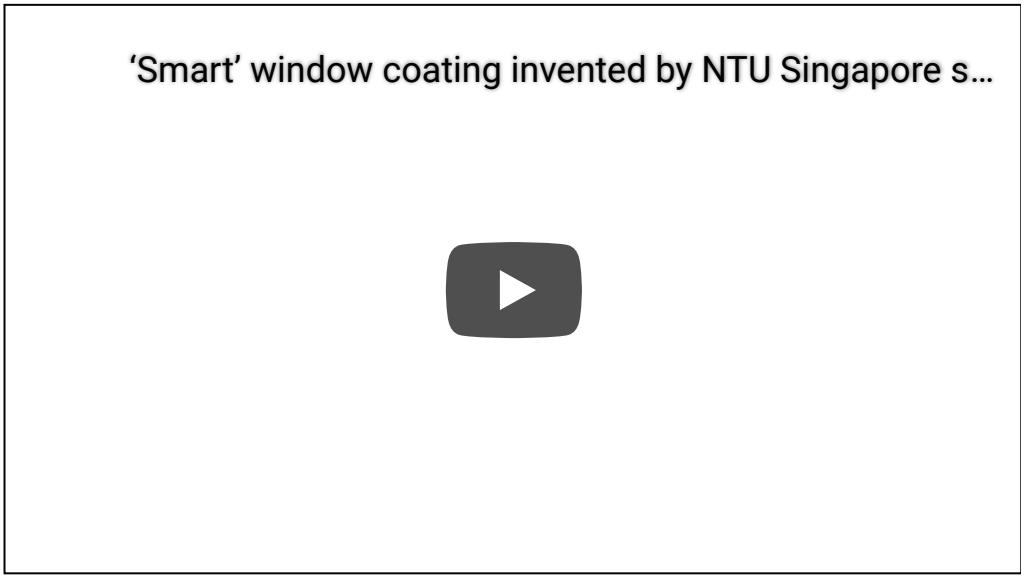
The new materials have specially designed nanostructures and are advanced materials such as titanium dioxide (TiO2), tungsten trioxide (WO3), neodimethyl-niobium (Nd-Nb), tin oxide (IV) (SnO2). Consists of.

The composite is intended to be coated on glass window panels, and when actuated by electricity, the user can “switch on and off” the transmission of

infrared radiation from the window.

The invention, which appears next to the cover of the journal ACSOmega, allows up to 90% of visible light to pass through, so it can block up to 70% of infrared light, according to experimental simulations, without compromising visibility through the window.

In addition, this material is about 30% more effective in controlling heat than commercially available electrochromic windows and is durable and cheaper to manufacture.



Improvements to the current electrochromic (EC) window

Electrochromic windows are a common feature of today’s “green” buildings. They are colored during use and work by reducing the amount of light entering the room.

Commercially available electrochromic windows typically have a layer of tungsten trioxide (WO3) coated on one side of the glass panel and not on the other side. When the window is turned on, the electric current moves the lithium ions to the side containing WO3, making the window dark or opaque. When the switch is turned off, the ions move away from the coated glass and the window clears again.

However, current electrochromic windows are only effective at blocking visible light, not infrared radiation. That is, the heat continues to pass through the window, warming the room.

Another drawback of current technology is its durability, as electrochromic components tend to degrade in 3-5 years.

In lab tests, NTU's electrochromic technology was subjected to rigorous on-off cycles to assess durability. The results show that the window properties maintain excellent stability (blocking over 65% of infrared radiation), demonstrating its excellent performance, feasibility, and potential for cost savings. Long-term use in sustainable buildings.

Alfred Tok, associate professor of materials science and engineering at NTU, the lead author of electrochromic window research, said: Most visible light can pass through whenever the electrochromic window is turned on.

The advanced material selection also helped improve the performance, stability and durability of smart windows. "

The new electrochromic technology could help save the energy used to heat and cool buildings, and could contribute to the future design of sustainable green buildings, the researchers say.

This research is a university effort to address the grand challenges of sustainability for humankind as part of the NTU 2025 Strategic Plan, which aims to accelerate the transformation of research discoveries into innovations that mitigate human impact on the environment. Reflects.

Next Generation Smart Window: Controls Both Infrared Radiation and Conducted Heat

Aiming to improve the performance of smart window technology, the NTU team has created a switch system that helps control conduction heat, which is heat from the external environment, in a separate task than reported in the journal.

The patented NTU switch consists of magnetic carbon-based particles and thin films, which are excellent thermal conductors. When the switch is turned off, conduction heat is not transferred through the window. When switched on, heat can pass through the glass window.

The team's smart windows, when integrated with newly developed electrochromic materials, can control two types of heat transfer: infrared

radiation and conducted heat, which is the main mode of heat transfer through matter.

Dr. Ronn Goei, Principal Investigator of the NTU School of Materials Science and Engineering, the lead author of this study, said: function.

With the ability to control both infrared radiant heat from the sun and conducted heat through windows, this technology can be used by building residents to adjust for heat loss or increase as needed, so it is warm. We expect it to be particularly useful in harsh climates. The seasons change while enjoying much of the scenery. "

Professor Shlomo Magdassi, co-author of the Institute of Chemistry at the Hebrew University of Jerusalem, said:

This is an excellent example of the scientific cooperation between NTU researchers and the Hebrew University of Jerusalem in Israel, made possible by the CREATE program of the National Research Foundation in Singapore. "

Exploring commercial potential

In the future, the research team wants to bring inventions from the lab to the market.

We are partnering with glass maker iGlass Asia Pacific for further testing to explore the possibility of incorporating smart windows into our projects to improve efficiency and sustainability.

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