Technology News

Scientists develop energy-saving 'smart window'

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In this news, we discuss the Scientists develop energy-saving 'smart window'.

Scientists have developed a liquid window panel that can simultaneously block the sun to regulate solar transmission, while trapping thermal heat that can be released day and night, thereby helping to reduce energy use in buildings.

Researchers at Nanyang Technological University, Singapore (NTU Singapore) developed their " smart window " by placing a hydrogel-based liquid in glass panels and

simulations, compared to traditional glass windows. It is also about 30% more energy efficient than commercially available low emissivity (energy efficient) glass, while being cheaper to manufacture.

The study was published in the journal Joule. The research team hopes to collaborate with industry partners to commercialize the smart window.

The " smart window " is the first reported example in a scientific journal of energy-saving smart windows made from liquid and supports the NTU Smart Campus vision of developing technologically advanced solutions for a sustainable future.

Windows are a key part of a building's design, but they are also the least energy efficient part. Because of the ease with which heat can be transferred through glass, windows have a significant impact on a building's heating and cooling costs.

According to a 2009 United Nations report, buildings account for 40% of the world's energy consumption and windows are responsible for half of that energy consumption.

Conventional low-emissivity, low-emissivity windows are made with expensive coatings that reduce infrared light entering or leaving a building, helping to reduce the demand for heating and cooling. However, they do not regulate visible light, which is a major component of sunlight that heats buildings.

To develop a window to overcome these limitations, NTU researchers turned to water, which absorbs a large amount of heat before it begins to heat up – a phenomenon known as high specific heat capacity.

They created a mixture of micro-hydrogel, water and a stabilizer, and found through experiments and simulations that it can effectively reduce energy consumption in a variety of climates, due to its ability to respond to a change in temperature. Thanks to the hydrogel, the liquid mixture becomes opaque when exposed to heat, thus blocking sunlight, and, when cold, returns to its original "clear" state.

At the same time, the high thermal capacity of water allows a large amount of thermal energy to be stored instead of being transferred through the glass and into the building during the hot day. The heat will then be gradually cooled and released at night.

“Our innovation combines the unique properties of two types of materials – hydrogel and water. By using a hydrogel based liquid, we simplify the manufacturing process to pour the mixture between two glass panels. This gives the window a unique advantage of high uniformity, which means the window can be created in any shape and size, ”said Dr. Long Yi, senior author and lecturer at the School of Materials Science. & Engineering.

Because of these characteristics, the NTU research team believes their innovation is best suited for use in office buildings, where opening hours are predominantly daytime.

As a proof of concept, the scientists carried out tests outdoors in hot (Singapore, Guangzhou) and cold (Beijing) environments.

The Singapore test found that the smart liquid window had a lower temperature (50 ° C) during the hottest part of the day (noon) compared to a normal glass window (84 ° C). Beijing’s tests showed that the room using the smart liquid window used 11% less energy to maintain the same temperature as the room with a normal glass window.

Scientists also measured when the highest value of stored thermal energy for the day occurred.

This “temperature peak” in the normal glass window was 12 p.m., and in the smart liquid window was moved to 2 p.m. If this peak temperature lag results in a lag in the time that a building needs electrical power to cool or heat the building, it should lead to lower energy prices for users.

Simulations using a real building model and weather data from four cities (Shanghai, Las Vegas, Riyadh and Singapore) showed that the smart liquid window had the best energy saving performance in all four cities compared to windows. ordinary glass and low-emissivity windows. .

Soundproofing tests also suggest that the smart liquid window reduces noise by 15% more effectively than double-glazed windows.

News Highlights:

Scientists develop an energy-efficient ‘smart window’

Smart liquid window reduces noise 15% more effectively