Adaptive glass assists heating and cooling

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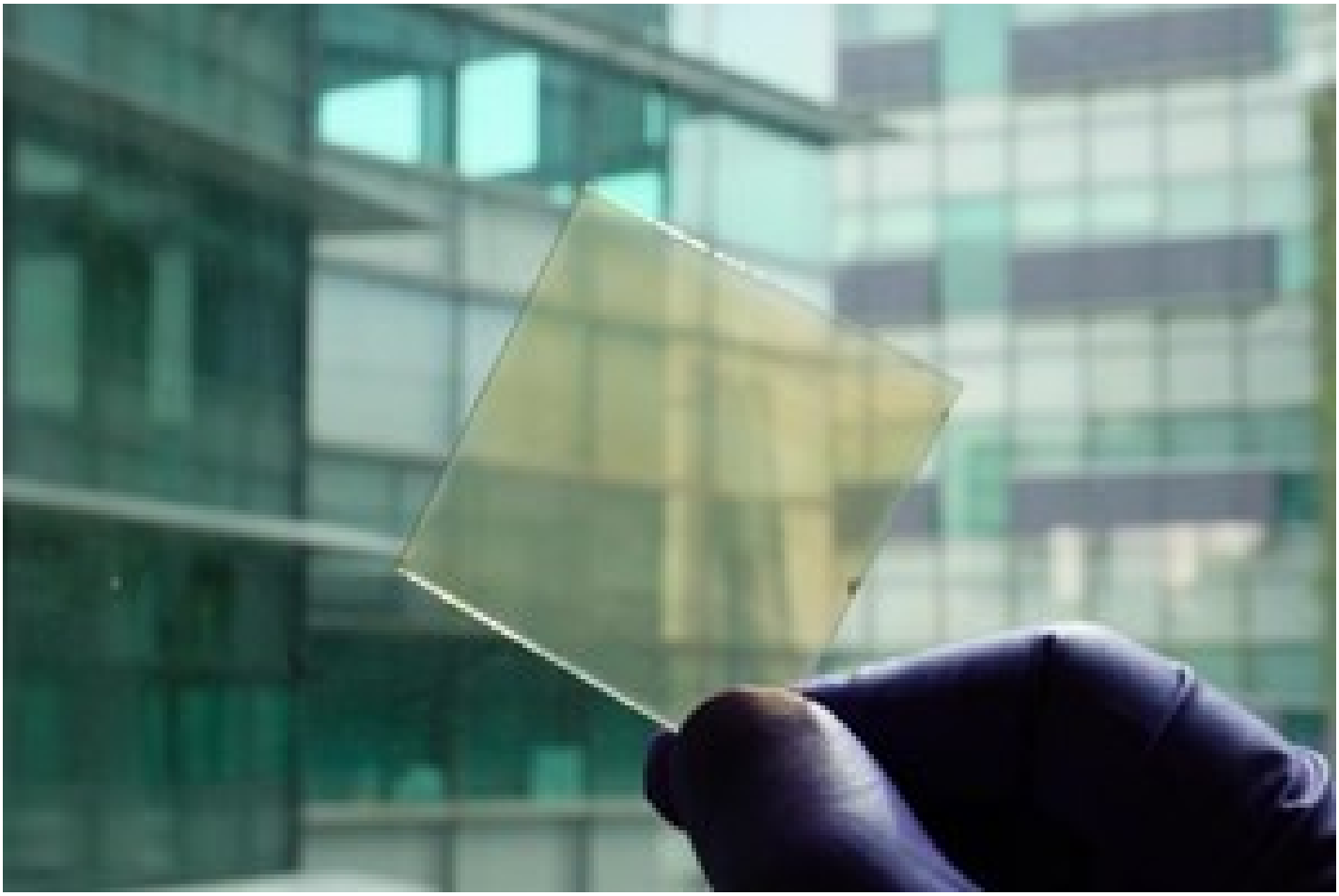

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(Credit: NTU Singapore)

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Scientists at NTU Singapore have developed an energy-saving glass that can automatically adapt to weather conditions to help heat or cool buildings.

Described in *Science* (https://www.science.org/doi/10.1126/science.abg0291), the glass was created using layers of vanadium dioxide nanoparticle composite, Poly(methyl methacrylate) (PMMA) and low-emissivity coating to form its unique structure. The material contains no electrical components and works by exploiting the spectrums of light responsible for heating and cooling.

During summer months, the glass suppresses solar heating (near infrared light) while boosting radiative cooling (long-wave infrared) to cool the room. In winter, it does the opposite to warm the room. According to the team, lab tests showed that the glass allowed a controlled amount of heat in various conditions proving its ability to react dynamically to changing weather conditions.

“Most energy-saving windows today tackle the part of solar heat gain caused by visible and near infrared sunlight. However, researchers often overlook the radiative cooling in the long wavelength infrared,” said principal investigator Dr Long Yi, NTU School of Materials Science and Engineering.

“While innovations focusing on radiative cooling have been used on walls and roofs, this function becomes undesirable during winter. Our team has demonstrated for the first time a glass that can respond favourably to both wavelengths, meaning that it can continuously self-tune to react to a changing temperature across all seasons.”

As a proof of concept, the scientists tested the energy-saving performance of their invention using simulations of climate data covering all populated parts of the globe (seven climate zones). Their results showed the glass achieved energy savings in both warm and cool seasons, with an overall energy saving performance of up to 9.5 per cent, or ~330,000kWh per year less than commercially available low-emissivity glass in a simulated medium sized office building.

According to the NTU Singapore team, the heating and cooling performance can also be customised to suit the needs of the market and intended region by adjusting the structure and composition of the nanocomposite coating on the glass.
