A coating that blocks 90 per cent of the heat from sunlight could be used to develop smart windows

August 24 2016

A*STAR researchers have developed a window coating that lets visible light through while blocking near-infrared radiation. Credit: A*STAR Singapore Institute of Manufacturing and Technology

By fine-tuning the chemical composition of nanoparticles, A*STAR researchers have developed a coating that is promising for fabricating smart windows suitable for tropical countries. Such windows block almost all the infrared heat from sun rays, while admitting most of the visible light.

The transparency of glass to visible light makes it the most common way to let light into a building. But because glass is also transparent to near-infrared radiation—windows also let in heat, giving rise to the well-known greenhouse effect. While this heating is welcomed in colder climates, it means that air conditioning has to work harder to maintain a comfortable temperature in in tropical climes.

Developing smart windows that allow most of the sun's light in, while blocking near-infrared radiation, would cut energy costs and reduce carbon emissions.

"In tropical Singapore, where air conditioning is the largest component of a building's energy requirements, even a small reduction in heat intake can translate into significant savings," notes Hui Huang of the A*STAR Singapore Institute of Manufacturing and Technology.

Huang and his co-workers have developed such windows by coating glass with tin oxide nanoparticles doped with small amounts of the element antimony. By varying the nanoparticles' antimony concentration, they could optimize their ability to absorb near-infrared radiation.

"Our infrared shielding coating, with 10-nanometer antimony-doped tin oxide nanoparticles, blocks more than 90 per cent of near-infrared radiation, while transmitting more than 80 per cent of visible light," says Huang. "These figures are much better than those of coatings obtained using commercial antimony-doped tin oxide nanopowders. In particular, the infrared shielding performance of our small antimony-doped tin oxide nanocrystals is twice that of larger commercial antimony-doped tin oxide powders."

The team produced the tiny nanoparticles using a synthesis technique known as the solvothermal method, in which precursors are heated under pressure in a special vessel, called an autoclave. The solvothermal

method permits synthesis at relatively low temperatures. It also enables the nanoparticle size to be tightly controlled, which is important when trying to block some wavelengths of light while allowing others to pass through.

The work has already attracted the interest of industry. "A local glass company supporting this project is interested in licensing this smart window technology with infrared shielding," says Huang. Potentially, the coating techniques could be applied on-site to existing windows, he adds.

More information: Hui Huang et al. Solvothermal synthesis of Sb:SnO2 nanoparticles and IR shielding coating for smart window, *Materials & Design* (2015). DOI: 10.1016/j.matdes.2015.09.013

Provided by Agency for Science, Technology and Research (A*STAR), Singapore