Transparent power-generating windows based on solar-thermal-electric conversion

August 10 2021, by Li Yuan

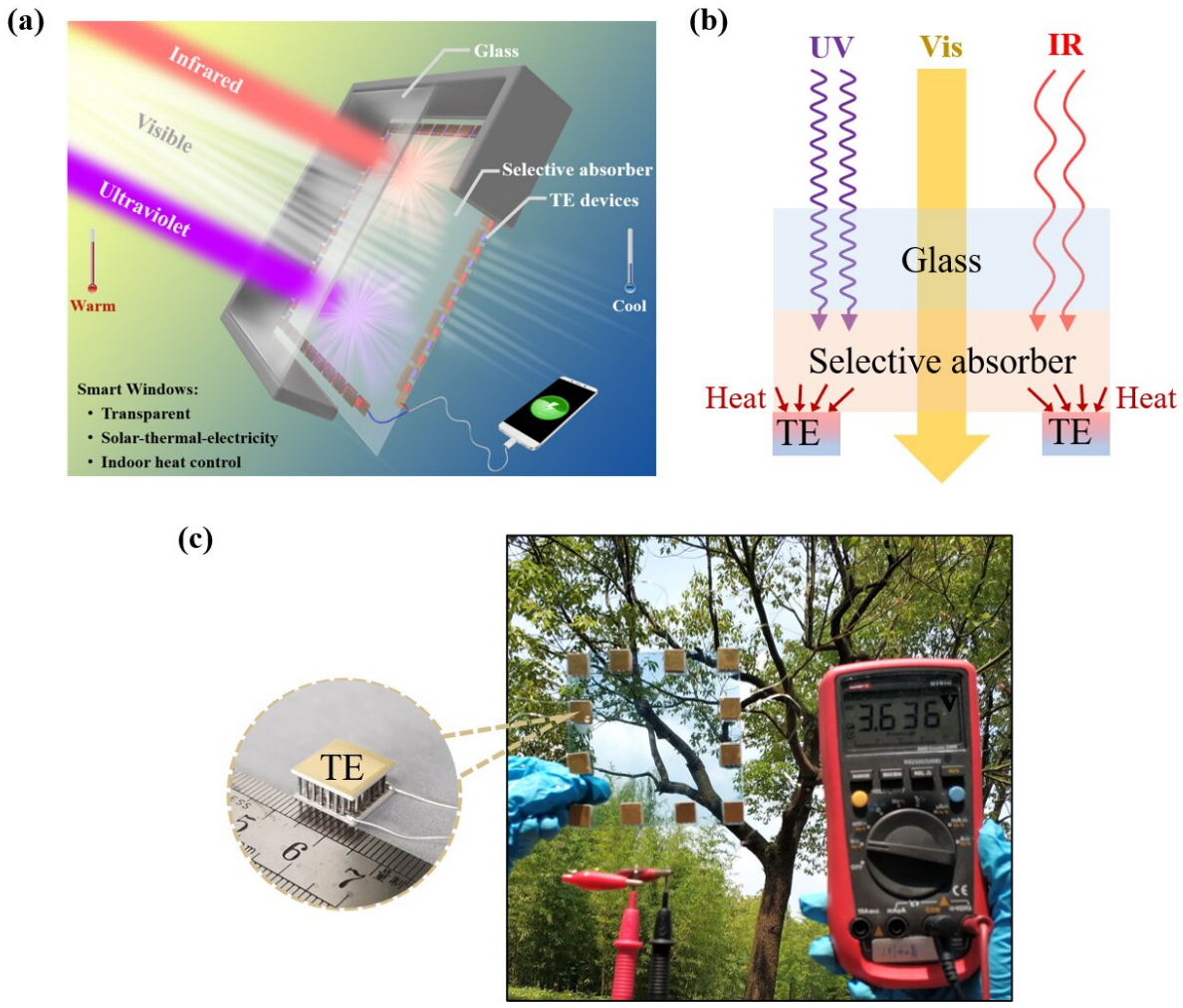

Fig. 1 Schematic diagram and demonstration of energy-saving power window technology based on solar-thermal-electric conversion. Credit: SICCAS

Windows are the most significant heat exchange channel between buildings and the outside environment, accounting for 50% of the energy inflow/lost from buildings. The use of windows for energy efficiency and power generation is a powerful complement to the use of roofs and walls.

The existing power generation window technology mainly combines transparent photovoltaic cells with architectural glass. However, the increased power generation efficiency often comes at the expense of window transparency.

Researchers from Shanghai Institute of Ceramics of the Chinese Academy of Sciences (SICCAS) proposed a new type of transparent power-generating window that combines solar-thermal-electric conversion with materials' wavelength-selective absorption. Relevant results were published in *Advanced Energy Materials*.

The wavelength-selective film, consisting of Cs0.33WO3 and resin, possesses high visible-light transmittance of up to 88%. Meanwhile it allows for efficient and selective harvesting of ultraviolet and infrared lights, and converts the absorbed light into heat.

Thermoelectric devices are designed to be arranged along the edge areas of the film. Heat is collected continuously by the large-area wavelength-selective film and then laterally conducted to the hot side of thermoelectric devices, where heat is converted into electricity.

This power-generating system decouples the energy conversion efficiency from light transparency of the window, thus enabling independent regulation for both. Meanwhile, owing to infrared light being absorbed, this technology can also reduce the cooling load of the buildings, achieving efficient energy savings.

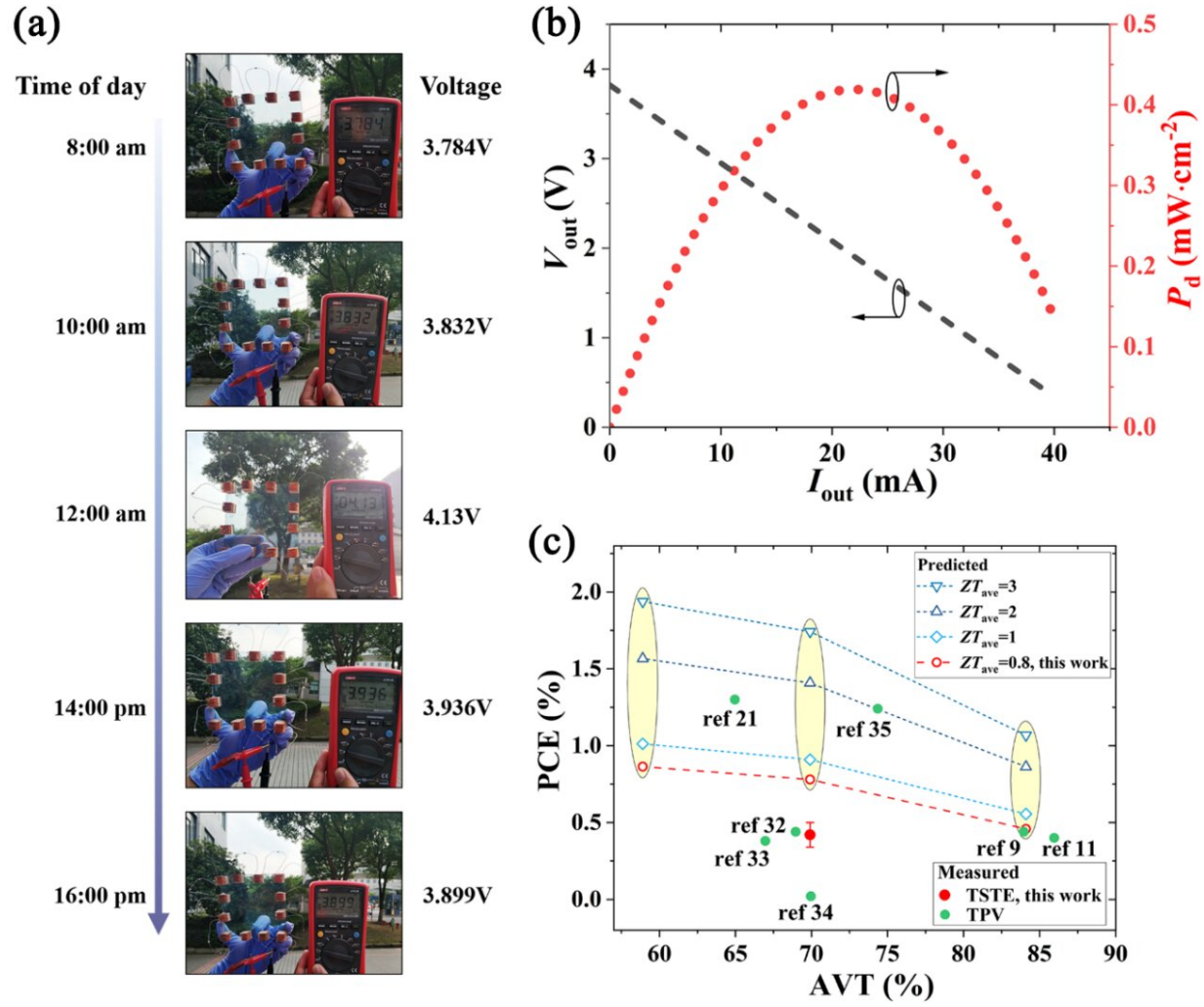

Fig. 2 Power-generating performance of a typical solar-thermal-electric power-generating window. Credit: SICCAS

More information: Qihao Zhang et al, Transparent Power-Generating Windows Based on Solar-Thermal-Electric Conversion, *Advanced Energy Materials* (2021). DOI: 10.1002/aenm.202101213