Supplementary Information

Transparent Wood Containing Cs₅WO₃ Nanoparticles for Heat-Shielding-Window Applications

Ziya Yu, Yongji Yao, Jianing Yao, Liangmiao Zhang, Zhang Chen, Yanfeng Gao* and Hongjie Luo

School of Materials Science and Engineering, Shanghai University, Shanghai 200444, China.

* To whom correspondence should be addressed:
Professor Yanfeng Gao
E-mail: yfgao@shu.edu.cn
Experimental Section

Characterization. The crystal structures of the Cs$_x$WO$_3$ nanoparticles were characterized by X-ray diffraction (XRD) with a Cu-K$_\alpha$ radiation of 1.5418 Å wavelength and settings of 40 mA and 40 kV. The surface morphology and energy dispersive spectrometer (EDS) of the Cs$_x$WO$_3$ nanoparticles were observed using a Scanning Electron Microscope (SEM, JEOL Manufacturing, Japan, JSM-6700F) with an EDS attachment. X-ray photoelectron spectroscopy (XPS) was employed for approximate elemental analyses. The transmittance spectra from UV to near-IR wavelengths (300-2500 nm; UH4150) of the Cs$_x$WO$_3$ nanoparticles in our work was measured by coating them onto PET substrates: firstly, the as-synthesized Cs$_x$WO$_3$ powders was dispersed in collodion-ethanol solution at a mass ratio of ethanol : collodion : Cs$_x$WO$_3$ = 1.0 : 0.93 : 0.15; then the coating solution was uniformly coated onto the PET substrates via bar coating method before drying naturally. The sheet resistance of ITO glass was measured by a four-point probe surface resistivity meter (JG, ST2263).

Supplementary Figures

Fig. S1 (a) XRD patterns of the Cs$_x$WO$_3$ particles (reference: Cs$_{0.32}$WO$_3$, JCPDS No. 831334); (b) SEM images of the Cs$_x$WO$_3$ particles; XPS spectra of the Cs$_x$WO$_3$ particles. (c) Full range XPS spectra; (d) deconvolution of the W4f core-level spectrum with peaks corresponding to the W6+ and W5+ oxidation states.
Fig. S2 EDS profile of the Cs$_x$WO$_3$ nanoparticles. The atomic ratio of Cs/W of Cs$_x$WO$_3$ nanoparticles was 0.32 according to the EDS measurements.

Fig. S3 Transmittance spectra of the Cs$_x$WO$_3$ nanoparticles.

Fig. S4 Images of model houses in order to show the temperature change after continuous simulate solar radiation: ITO glass house (a) after 0 min, (b) after 3 min, (c) after 10 min. The sheet resistance of ITO glass was 4.2 $\Omega\square^{-1}$. 