Electronic Supplementary Material (ESI) for Chemical Communications

Supporting Information

Discovery of an excellent IR absorbent with broad working waveband: Cs_xWO_3 nanorods

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Experimental

Analytical grade chemicals, tungsten hexachloride (WCl_6), cesium hydroxide monohydrate ($CsOH·H_2O$), dehydrated ethanol and acetic acid, purchased from Kanto Kagaku Co.Inc. were used without further purification as starting materials. In a typical experiment, a certain amount of WCl_6 was dissolved into the dehydrate ethanol with violently stirring, then the desired amount of CsOH was introduced to the above yellowish solution of WCl_6. After becoming the mixture homogeneous, 10ml acetic acid was introduced. The final concentration was adjusted to 0.015M of WCl_6 with 50 at.% of CsOH. The mixed solution was introduced into a Teflon-lined autoclave of 100 ml internal volume, followed by solvothermal treatment at 240^{o}C for 20h.

This method, which is named as *water controlled-release solvothermal process(WCRSP)*, is a novel and facile method to synthesize nanorods of tungsten bronze type Cs_xWO_3. Water molecules were released slowly by the reaction between acetic acid and dehydrate ethanol during the solvothermal process. More details about the *WCRSP* were shown in Ref.1and Ref.2. Dark blue colored products were centrifuged and washed with water and ethanol 4 times, respectively, followed by vacuum drying at 60^{o}C over night. It was found that the calcinations under atmosphere of N_2 at 500^{o}C further enhanced the absorption ability of Cs_xWO_3.

The coating slurry was formed by mixing the Cs_xWO_3 powder with collodion and ethanol at a mass ratio of ethanol: collodion: Cs_xWO_3=1:0.93:0.15. Then, the coating slurry was painted on a quartz glass by an applicator with concave in depth of 12.5μm. The phase compositions of the samples were characterized by X-ray diffraction analysis (XRD, Shimadzu XD-1) using graphite-monochromized *CuKα* radiation. The size and shape of the nannoparticles were observed by transmission electron microscopy (TEM, JEOLJEM-2010). The optical response of the thin film was measured by using a spectrophotometer (JASCO V-670), giving output of transmittance in the UV, visible, and infrared ranges (200-2700nm). Energy-dispersive X-ray spectrometer (EDS) was employed for approximate elemental analyses. FT-IR measurements were conducted by using the FTS7000 series (DIGILIB). Thermographic measurements were recorded by thermographicmeter (FLIR System i7).

∗ **Ref.1** C. S. Guo, S. Yin, P. L. Zhang, M. Yan, K. Adachi, T. Chonan and T. Sato, J. Mater. Chem., 2010, 20, 8227–8229.

Ref.2 C. S. Guo, S. Yin, M. Yan, and T. Sato, J. Mater. Chem., 2011, DOI: 10.1039/c0jm04379f.

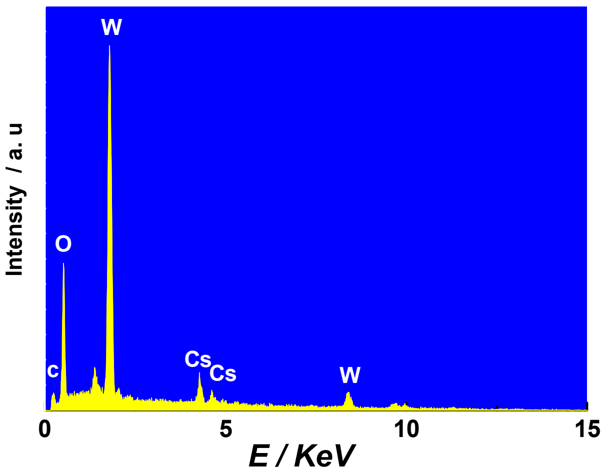

Fig.S1 EDS profile of Cs_xWO_3 nanorods

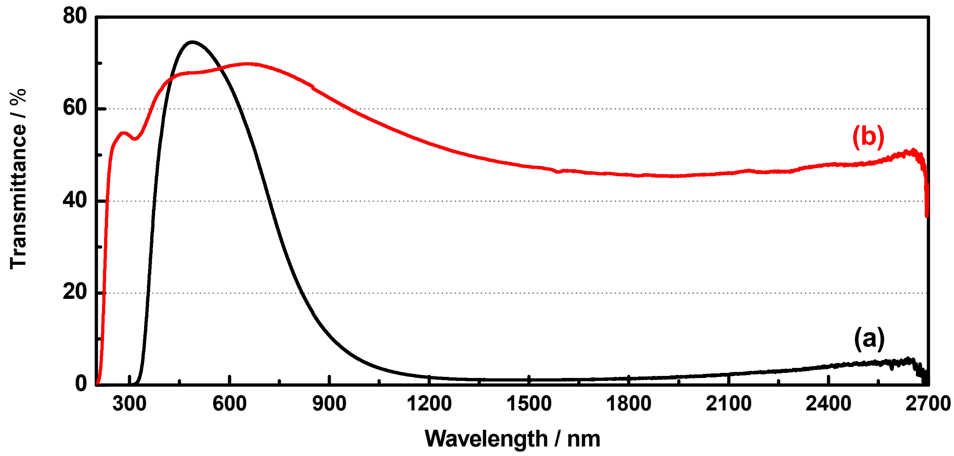

Fig.S2 Transmittance spectra of (a) $Cs_{0.32}WO_3$ nanorods synthesized by *WCRSP* process and (b) $Cs_{0.32}WO_3$ synthesized by solid state reaction.

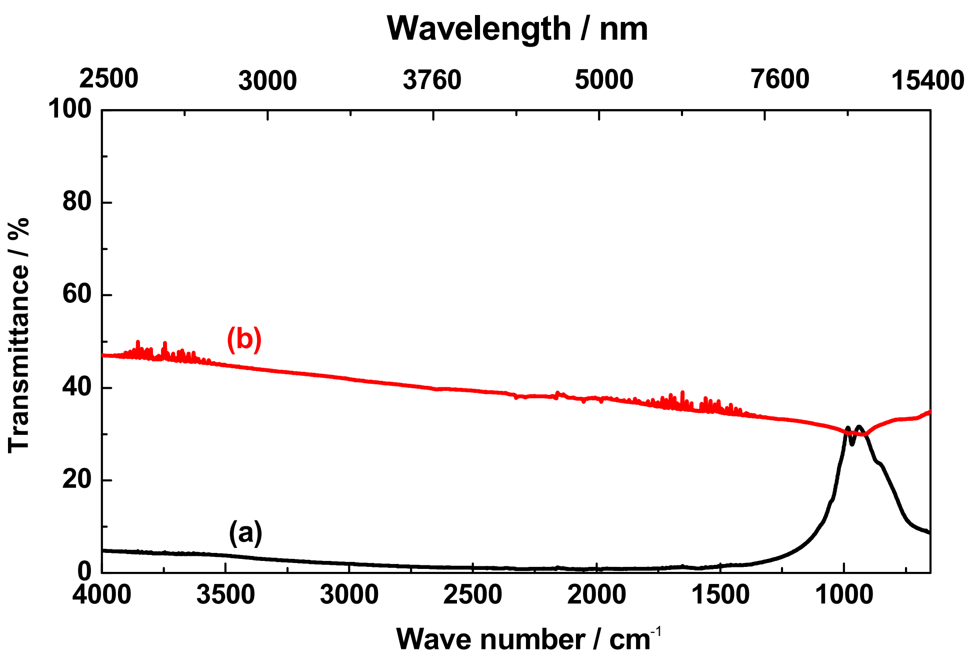

Fig.S3 FT-IR spectra of (a) $Cs_{0.32}WO_3$ nanorods synthesized by *WCRSP* process and (b) $Cs_{0.32}WO_3$ synthesized by solid state reaction.

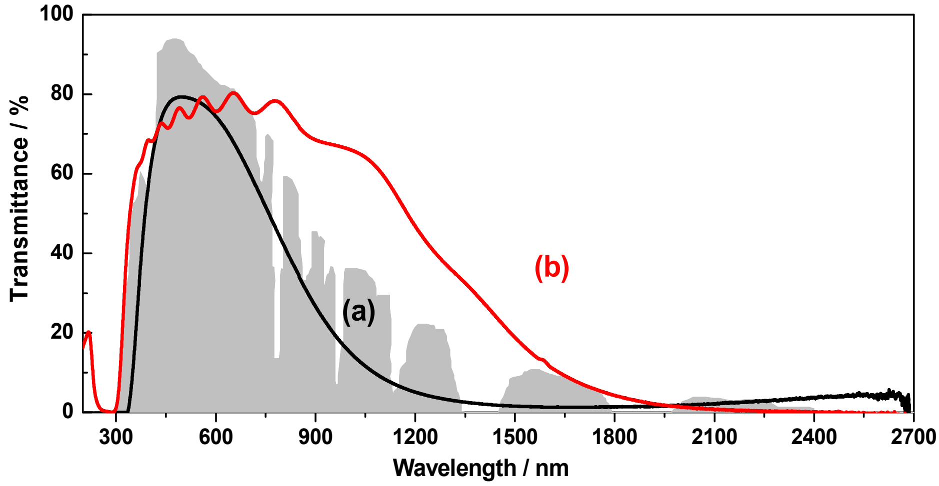

Fig.S4 Transmittance spectra of (a) the thin film of $Cs_{0.32}WO_3$ nanorods synthesized by *WCRSP* process and (b) ITO glass (10 $\Omega\cdot\square^{-1}$)

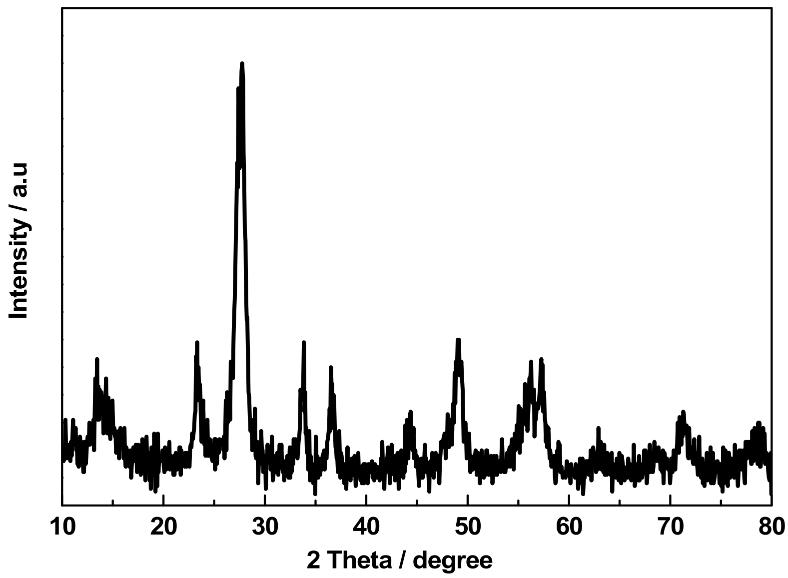

Fig.S5 XRD pattern of Cs_xWO_3 nanorods

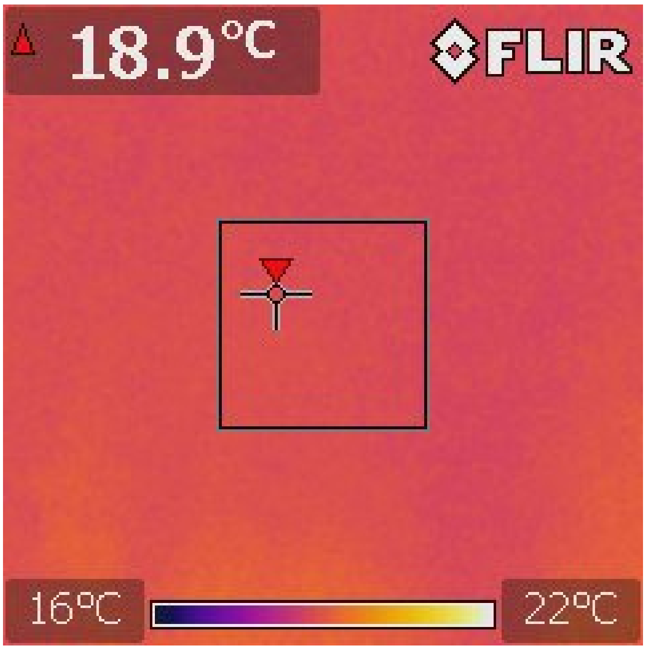

Fig.S6 Thermographic image of $Cs_{0.32}WO_3$ powder before irradiation.

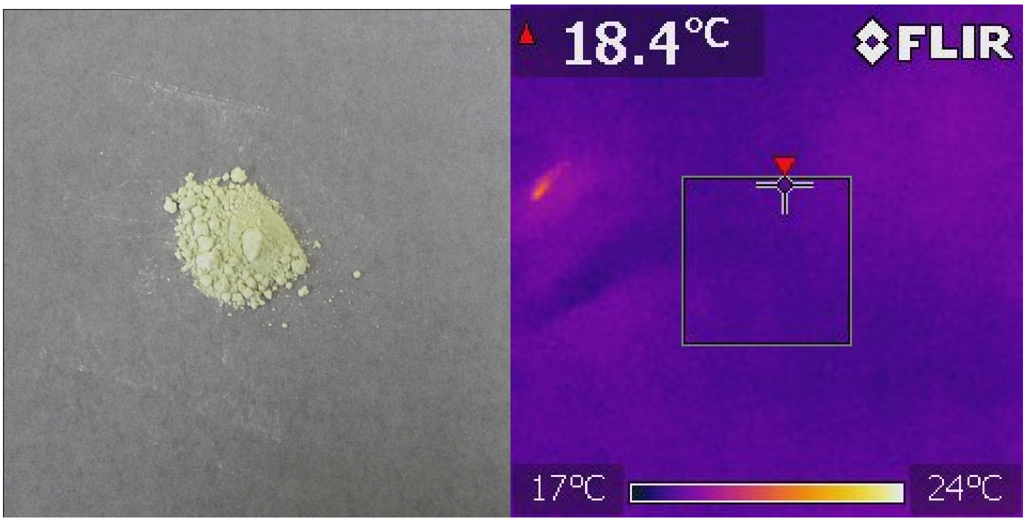

Fig.S6 Thermographic image of WO_3 powder after irradiation for 10 seconds.

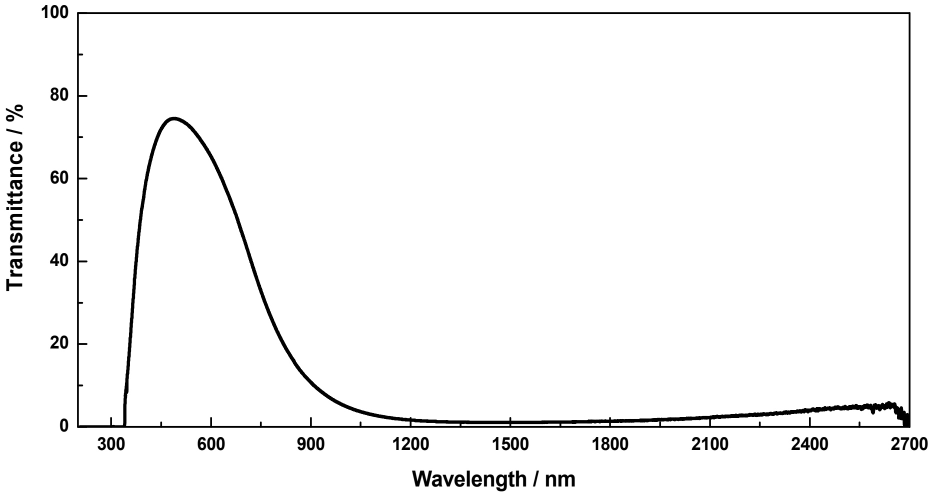

Fig.S7 The transmittance spectra of Cs_xWO_3 coated on common glass.