Electronic Supplementary Information

Ferroelectric polyoxometalate modified nano semiconductor TiO_2 for increasing electrons lifetime and inhibiting electrons recombination in Dye-Sensitized Solar Cells

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Supplementary Experimental Section

Photoelectrochemical measurements: Thephotocurrent curve was measured on the CHI601D electrochemical workstation (Shanghai Chenhua Instrument Corp., China) with the solar simulator at room temperature. The Cyclic voltammetry curves were carried out on a CHI601D electrochemical workstation (Shanghai Chenhua Instrument Corp., China) at room temperature by a three-electrode system. Glassy carbon electrode was the working electrode, a standard Ag/AgCl and Pt were reference electrode and counter electrode. The electrolyte was 0.05 mol L^{-1}KCl aqueous solution.

Material characterizations: Bruker AXS TENSOR-27 FTIR spectrometer by KBr pellets was used to test the IR spectra from 4000 cm^{-1} to 400 cm^{-1}. The datas of Powder X-ray diffraction (XRD) were acquired on a Bruker AXSD8 Advance diffractometer in a 2θ scope of 5-80° at a rate

of 10° depending on Cu Ka radiation (λ = 1.5418 Å). Scanning electron microscope (SEM), Energy dispersive X-ray (EDX) and Energy dispersive spectroscopy (EDS) spectrometry Element mapping were completed by means of a FEI Quanta 200F microscope involving a 20 kV speeding up voltage. The Transmission electron microscope (TEM) images were performed with accelerating voltage of 200 kV on a JEOL-2100F transmission electron microscope. The XPS was completed on an ESCALAB 250Xi photoelectronic spectrometer of F-doped SnO_2 glass with an internal reference of C1s photoelectron at 284.6 eV peak and an Al Ka radiation X-ray source. The Uv-vis was tested at the spectral range from 200 nm to 900 nm on an Ultraviolet spectrophotometer of China SP-756P. The photoluminescent spectrum (PL) was carried out on a Hitachi F-4500 fluorescence spectrophotometer.

Supplementary Figures

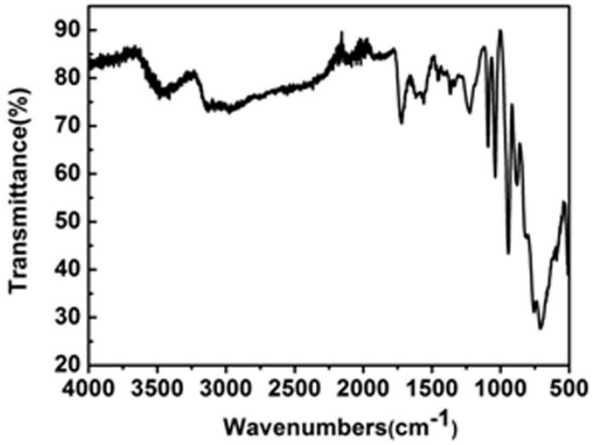

Fig.S1 IR of Sm.

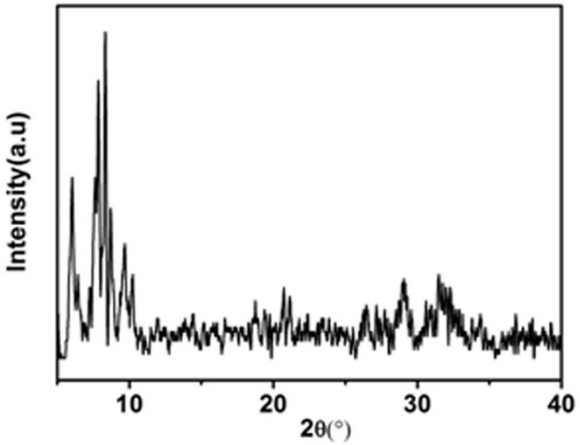

Fig. S2 PXRD patterns of Sm.

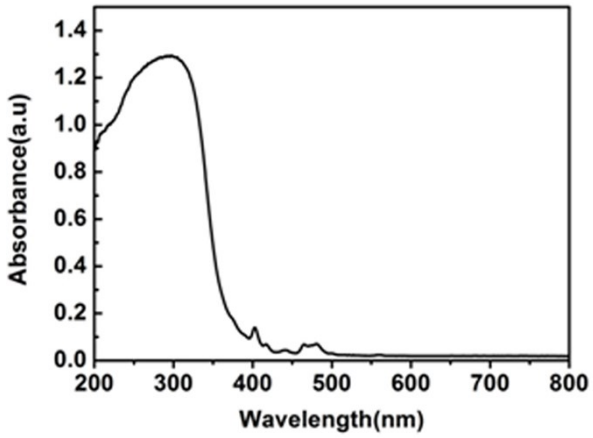

Fig. S3 UV–vis absorption spectra of Sm.

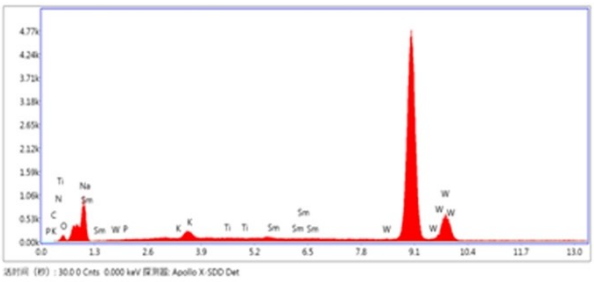

Fig. S4 EDS spectrum of Sm@TiO_2/P25.

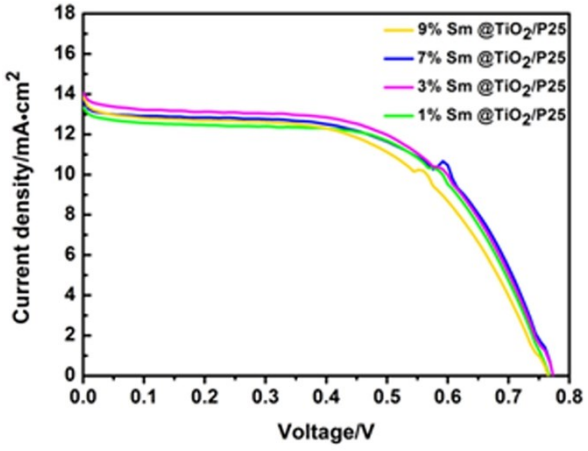

Fig. S5 *J-V* curves of DSSCs based on different mass concentrations of Sm@TiO_2/P25 in the photoanodes.

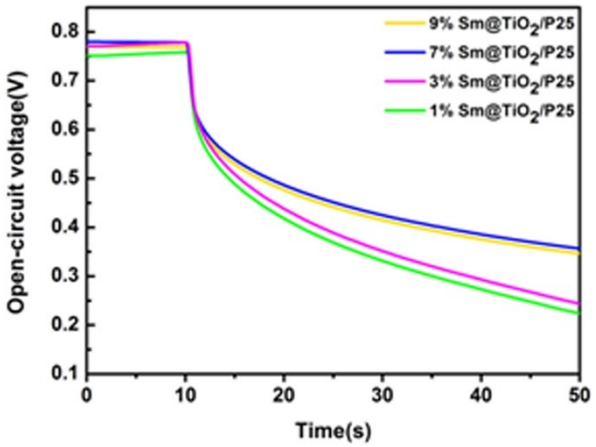

Fig. S6 OCVD spectra of DSSCs based on different mass concentrations of Sm@TiO_2/P25 in the photoanodes.

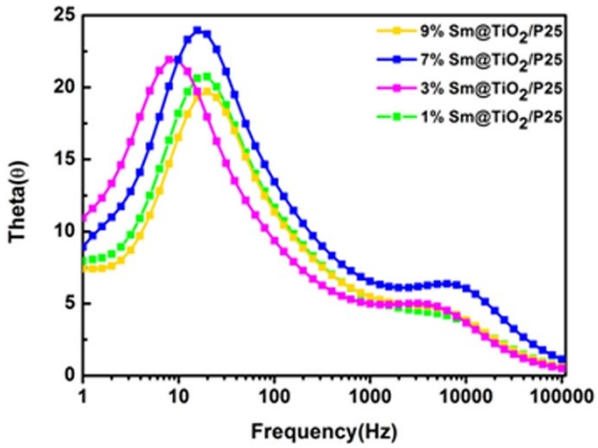

Fig. S7 Bode phase diagrams of DSSCs based on different mass concentrations of Sm@TiO_2/P25 in the photoanodes.

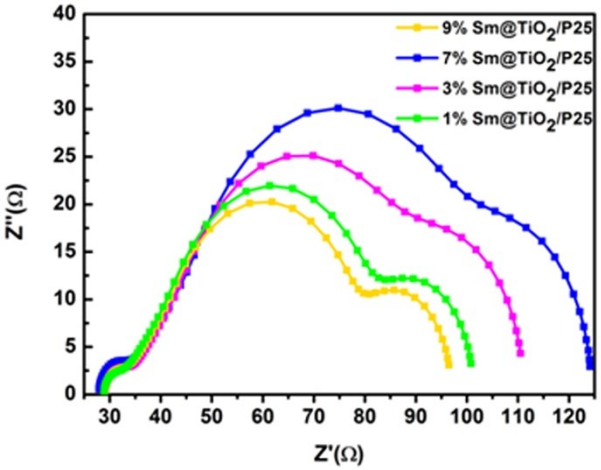

Fig. S8 The EIS spectra of DSSCs based on different mass concentrations of Sm@TiO_2/P25 in the photoanodes.

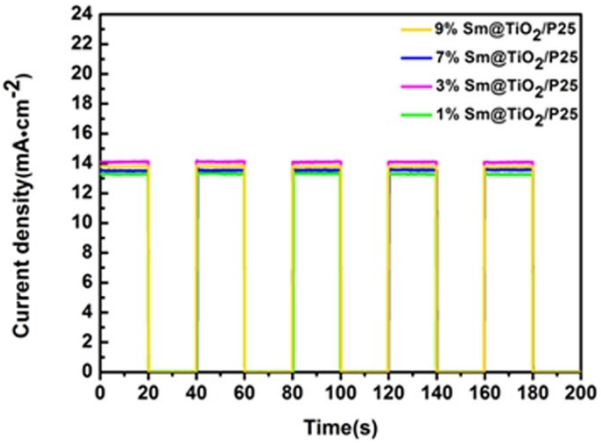

Fig. S9 The photocurrent response of DSSCs based on different mass concentrations of Sm@TiO_2/P25 in the photoanodes.

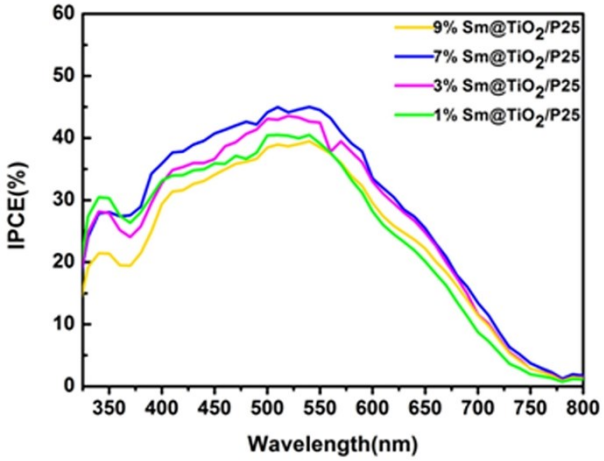

Fig. S10 The IPCE of DSSCs based on different mass concentrations of Sm@TiO_2/P25 in the photoanodes.

Fig. S11 Equivalent circuit used to fit the impedance measurements on the DSSCs.

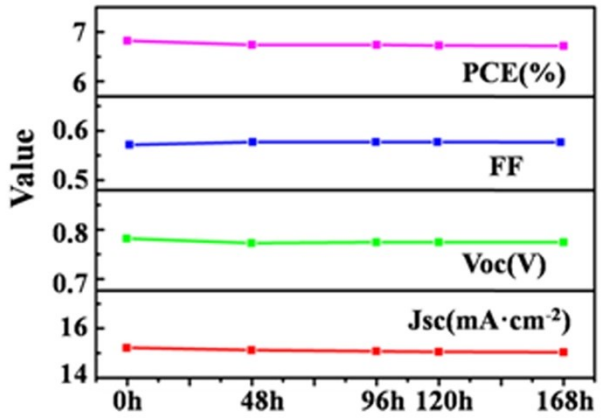

Fig.S12 Long-term stability of DSSCs based on 5%Sm@TiO_2/P25.

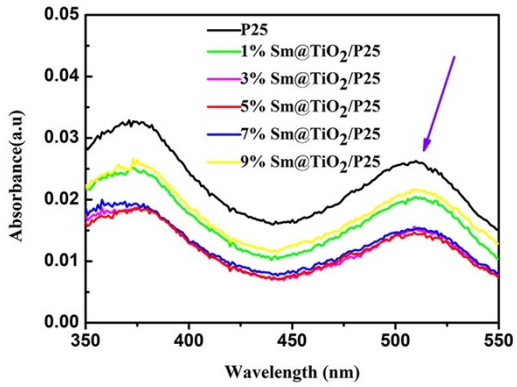

Fig. S13 UV-vis absorption spectrum of TiO_2 and different concentrations of Sm@TiO_2/P25 films.

Table S1 The corresponding dye-loading values of TiO_2 and different concentrations of Sm@TiO_2/P25 films.

Samples	Dye-loading values / mol
TiO_2	1.862695×10^{-9}
1% Sm@TiO_2/P25	1.447660×10^{-9}
3% Sm@TiO_2/P25	1.105390×10^{-9}
5% Sm@TiO_2/P25	1.041418×10^{-9}
7% Sm@TiO_2/P25	1.091844×10^{-9}
9% Sm@TiO_2/P25	1.536879×10^{-9}