Electronic Supplementary Material (ESI) for Nanoscale.

Enhanced electrochromic switches and tunable green fluorescence based on terbium ion doped WO_3 film

Luying Shen, Jianming Zheng, Chunye Xu*

Hefei National Laboratory for Physical Sciences at the Microscale, CAS Key Laboratory of Soft Matter Chemistry, Department of Polymer Science and Engineering, University of Science and Technology of China, Hefei 230026, PR China

*Corresponding Author：

*E-mail: chunye@ustc.edu.cn

Address: Hefei National Laboratory for Physical Sciences at the Microscale, CAS Key Laboratory of Soft Matter Chemistry, Department of Polymer Science and Engineering, University of Science and Technology of China, Hefei 230026, P.R. China.

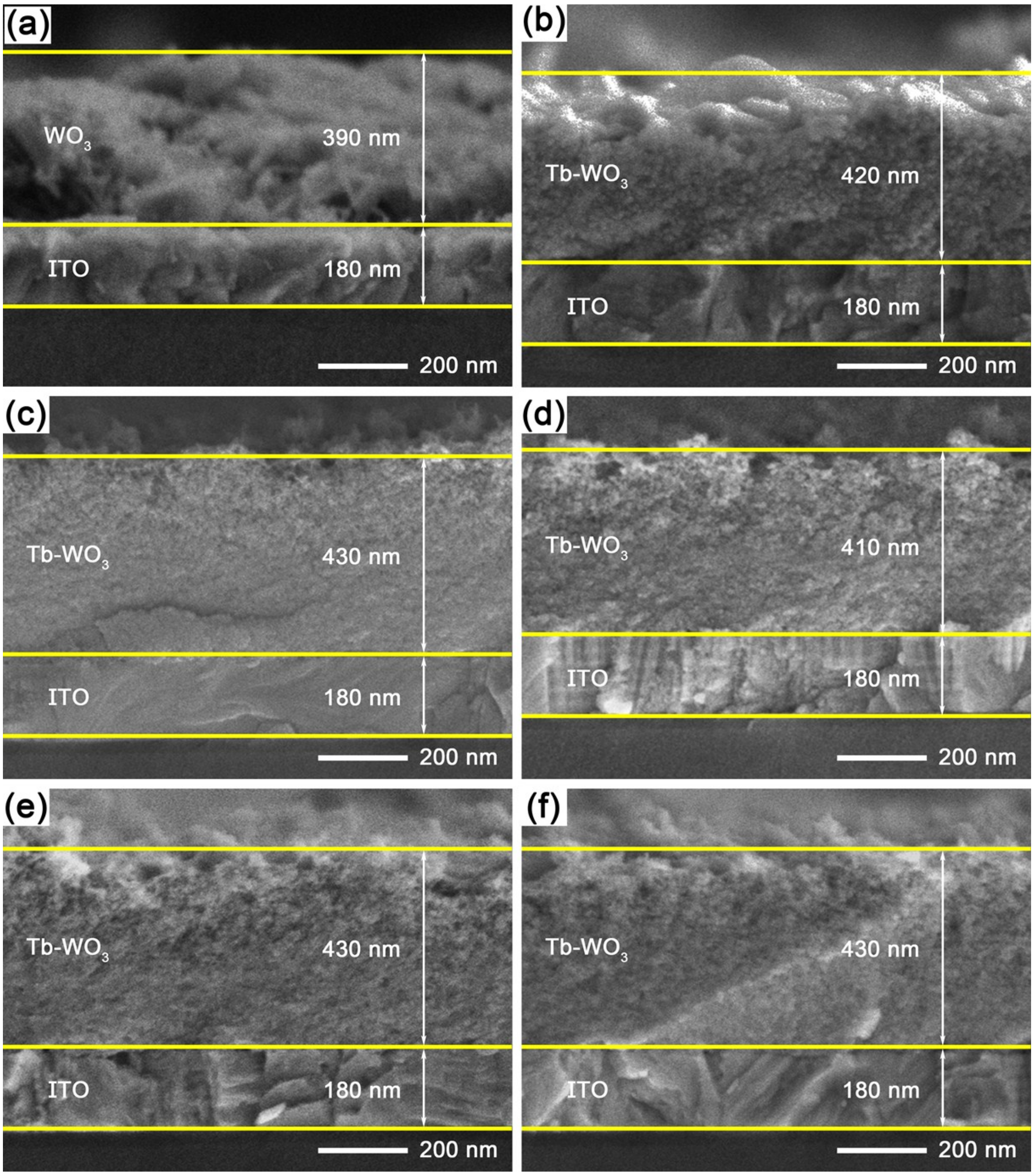

Fig. S1. SEM cross-sectional views of Tb-WO_3 films with different doping contents: (a) 0%, (b) 5%, (c) 10%, (d) 12%, (e) 13% and (f) 15%.

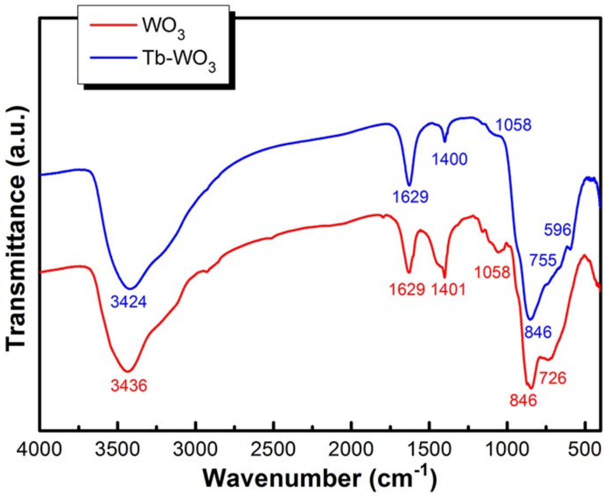

Fig. S2. FT-IR spectra of pristine and typical 13% Tb doped WO_3 films in the 4000-400 cm^{-1} wavenumber region.

FT-IR spectra in Fig. S1 were collected to further elucidate the structure changes induced by Tb ions doping. The spectrum of pristine WO_3 film can be roughly divided into two regions: 500 cm^{-1} to 1100 cm^{-1} with vibrations of the W-O-W and O-W-O bonds, and above 1300 cm^{-1} with vibrations of the H-O-H bonds. The additional peak at 846 nm can be attributed to W=O bonds. Tb doped WO_3 film exhibits the similar characteristic absorption of WO_3 species, indicating that the Tb ions may have entered into the WO_3 lattice without the obvious change of chemical band.

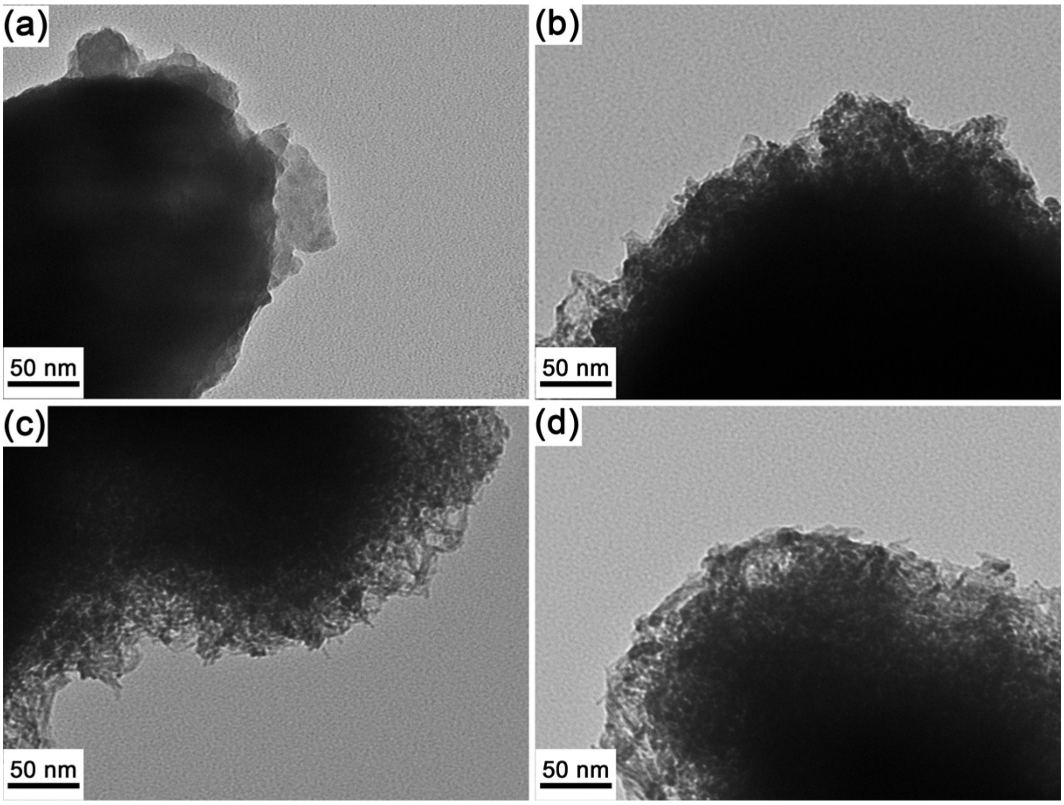

Fig. S3. TEM images of Tb-WO_3 films with different doping contents: (a) 5%, (b) 10%, (c) 12%, (d) 15%.

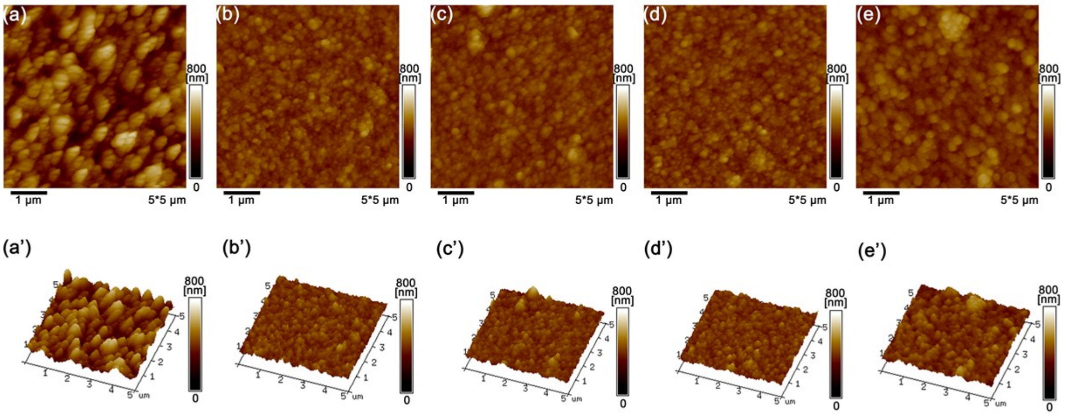

Fig. S4. AFM images in (a-e) surface topography and (a'-e') 3D stereogram of Tb-WO_3 film with various doping concentrations (0%, 5%, 10%, 12% and 15%).

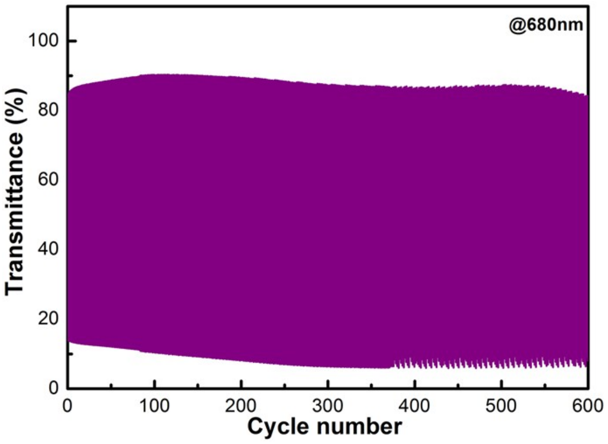

Fig. S5. Cyclic stability of transmittance switching for 13% Tb-doped WO_3 film monitored at 680 nm. The film was cycled in 0.5 M H_2SO_4 aqueous electrolyte under double-potential step between at -1 V for 15 s and 1.5 V for 15 s *vs.* Ag/AgCl.