Supporting Information

Cesium-doped Vanadium Oxide as the Hole Extraction Layer for Efficient Perovskite Solar Cells

Xiang Yao,[a] Jun Qi,[a] Wenzhan Xu,[a] Xiaofang Jiang,[a] Xiong Gong,[a,b,*] and Yong Cao[a]

[a] *Institute of Polymer Optoelectronic Materials and Devices, State Key Laboratory of Luminescent Materials & Devices, South China University of Technology, Guangzhou 510640, P. R. China.*

[b] *Department of Polymer Engineering, College of Polymer Science and Polymer Engineering, The University of Akron, OH 44325, USA*

*Corresponding author, Email: xgong@uakron.edu; Fax: (330) 972 3406

Contents

Table S1. Photovoltaic parameters of PSCs with VO_X:0.3Cs HELs of different metavanadate concentrations

Figure S1. XPS spectrum of N 1s of the pristine VO_X and VO_X:yCs thin films

Figure S2. The UPS data of pristine VO_X and VO_X:0.3Cs thin films

Figure S3. The stability of the devices with different HELs over 30 days of storage in air

Table S1. Photovoltaic parameters of the PSCs with the VO_X:0.3Cs HELs, where the VO_X:0.3Cs HELs are processed from different metavanadate concentrations

Metavanadate concentration (mg/mL)	V_{OC} [V]	J_{SC} [mA cm^{-2}]	FF [%]	PCE [%]
HEL-free	0.71	17.38	65.59	8.17
7.0	0.83	18.39	70.59	10.72
13.3	0.92	20.67	76.46	14.48
20	0.86	18.86	73.83	12.01

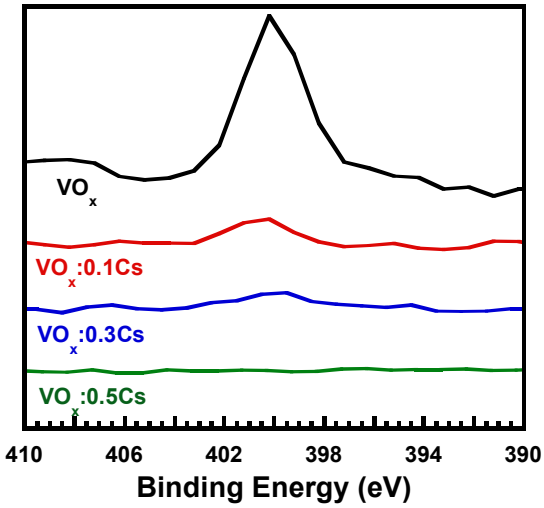

Figure S1. XPS spectrum of N 1s of pristine VO_X and VO_X:yCs thin films.

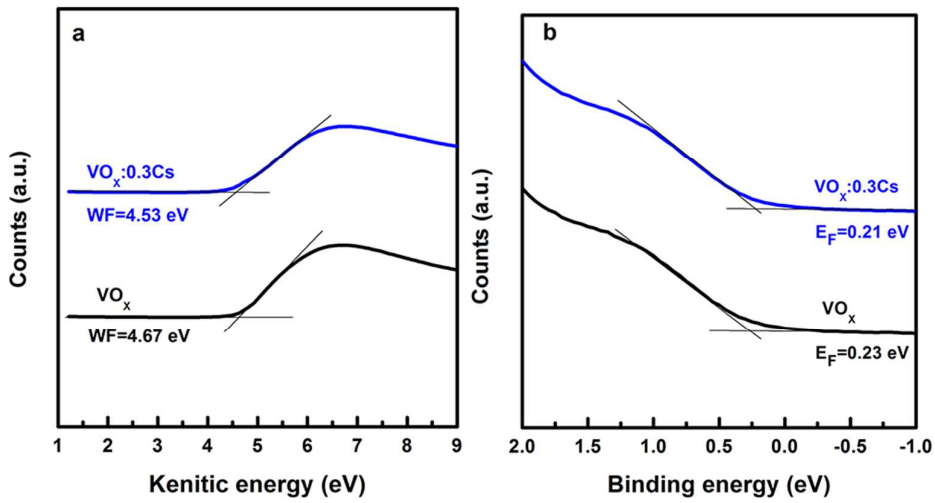

Figure S2. The UPS data of pristine VO_X and VO_X:0.3Cs thin films on the top of ITO showing (a) the secondary electron cut-off region and (b) the fermi level (E_F) region.

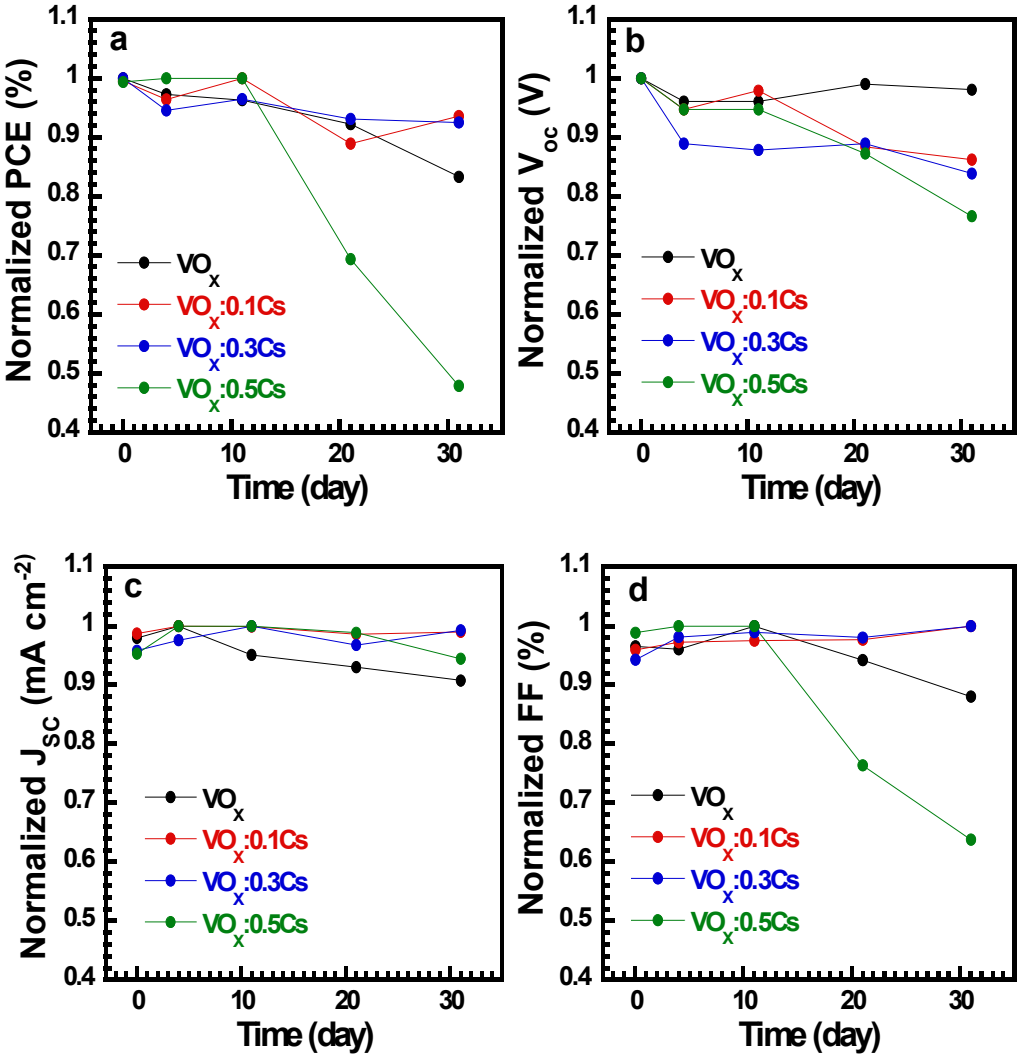

Figure S3. Evolution of J_{SC} (a), V_{OC} (b), FF (c) and PCE (d) for PSCs with different HELs over 30 days, stored in air.