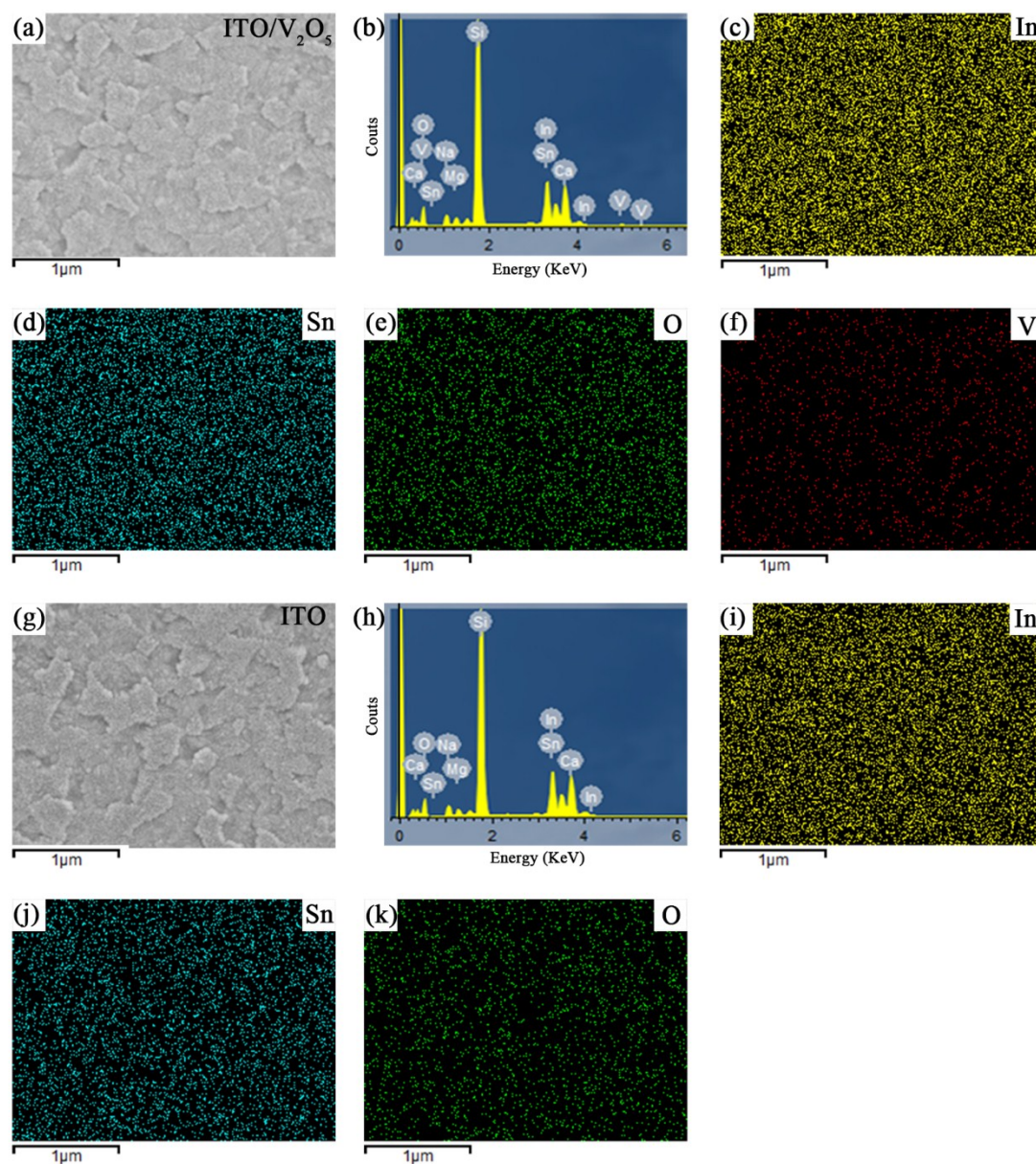
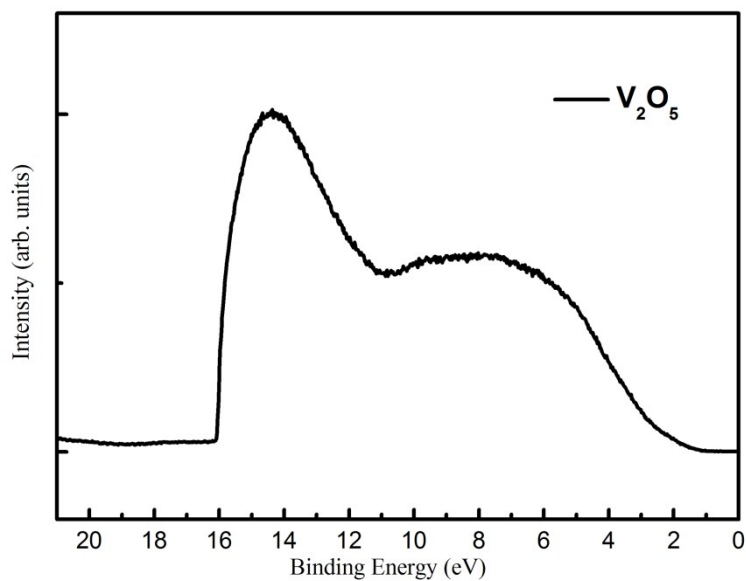


## Electronic Supplementary Information

### Electronic



**Fig. S1** The FESEM images (a and g), EDS spectra (b and h) and mapping for In (c and i), Sn (d and j), O (e and k) and V element (f) of the ITO/V<sub>2</sub>O<sub>5</sub> film (a-f) and ITO electrode (g-k).



**Fig. S2** The UPS spectra of  $V_2O_5$  film.

**Tab. S1** The change of key performance parameters of PSCs with four different structures after 300 h, including  $V_{OC}$ ,  $J_{SC}$ , FF and PCE.

Device	$V_{OC}$ (V)			$J_{SC}$ (mA/cm <sup>2</sup> )			FF			PCE (%)		
	0h	300h	rate (%)	0h	300h	rate(%)	0h	300h	Rate (%)	0h	300h	rate(%)
with $V_2O_5$ and Bphen	0.94	0.91	96.8	22.88	17.87	78.1	0.73	0.72	98.6	15.49	11.45	73.9
with only $V_2O_5$	0.89	0.76	85.4	21.80	16.64	76.3	0.64	0.43	67.2	12.85	5.36	41.7
with only Bphen	0.92	0.89	96.7	20.49	15.23	74.3	0.71	0.62	87.3	13.98	8.54	61.1
none	0.86	0.68	79.1	19.26	9.29	48.2	0.64	0.21	32.8	11.08	1.22	11.0