

Electronic Supplementary Information

Interface engineering of perovskite solar cells with PEO for improved performance

H. P. Dong^{a)}, Y. Li^{b)}, S. F. Wang^{b)}, W. Z. Li^{a)}, N. Li^{a)}, X. D. Guo^{a)} and Liduo Wang^{*a)}

a)Key Lab of Organic Optoelectronics and Molecular Engineering of Ministry of Education, Department of Chemistry, Tsinghua University, Beijing, P.R.China. E-mail: chldwang@mail.tsinghua.edu.cn

b)Institute of Modern Optics & State Key Laboratory for Artificial Microstructure and Mesoscopic Physics, School of Physics, Peking University, Beijing, P.R. Chian.

Table of content

Fig. S1. Contact angle test for films of FTO/TiO_x and FTO/TiO_x/PEO

Fig. S2 The dissolving situation of PEO in different solvents.

Fig. S3 Cross section image of device with PEO layer.

Fig. S4 Survey of the XPS spectra including C1s, O1s, Ti2p peaks.

Fig. S5 Distribution of the photovoltaic parameters of the solar cells (V_{oc} , J_{sc} , FF and PCE): black squares for the devices with TiO_x as ETL and red dots for the devices with TiO_x/PEO as ETL.

Fig. S6 *J*-*V* curves of PEO modified perovskite solar cell tested under forward and reverse scan.

Fig. S7 UV-vis absorption and Steady-state PL spectra of films: FTO/TiO_x/MAPb_xCl_{3-x} (black curve) and FTO/TiO_x/PEO/MAPb_xCl_{3-x}(red curve).

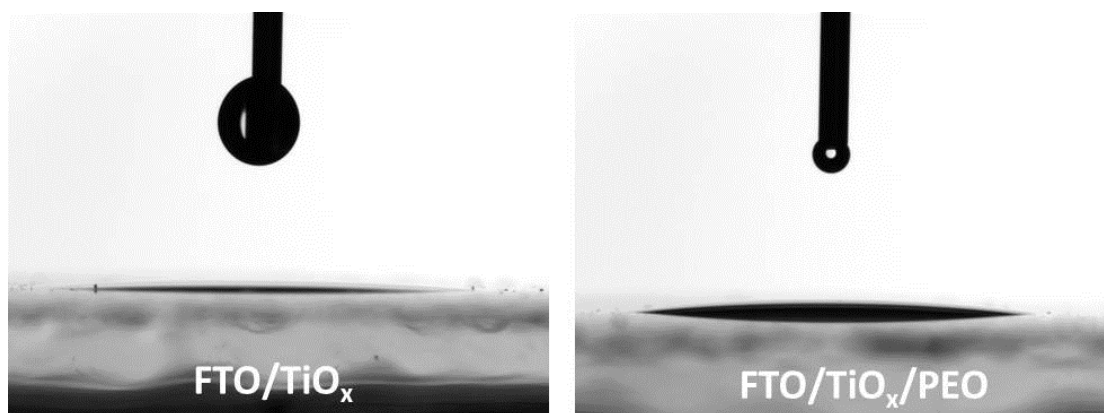


Fig. S1 Contact angle test for films of FTO/TiO_x and FTO/TiO_x/PEO

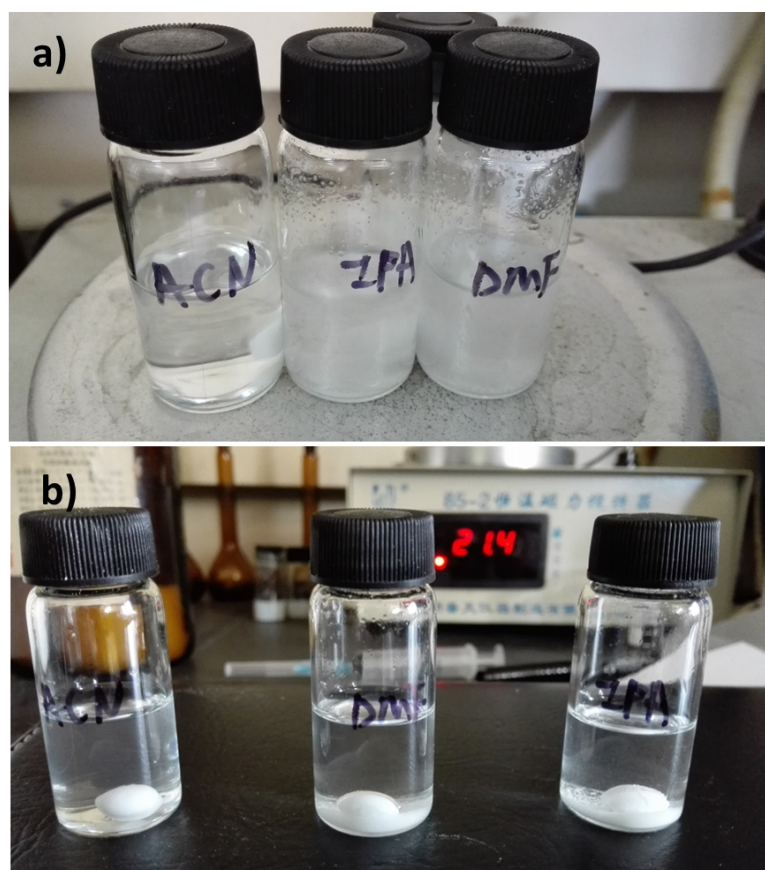


Fig. S2 The dissolving situation of 50mg PEO in 5 mL acetonitrile (solvent for PEO we used), isopropanol (solvent for Al_2O_3 nanoparticles) and dimethyl formamide (solvent for perovskite precursor). a) after stirring for 5 minutes; PEO dissolved fully in acetonitrile; the solutions with isopropanol and dimethyl formamide as solvent were still quite cloudy. b) standing for 2 minutes after stirring for 15 minutes. No precipitation was noticed for acetonitrile. But much PEO was left at the bottom for isopropanol and dimethyl formamide.

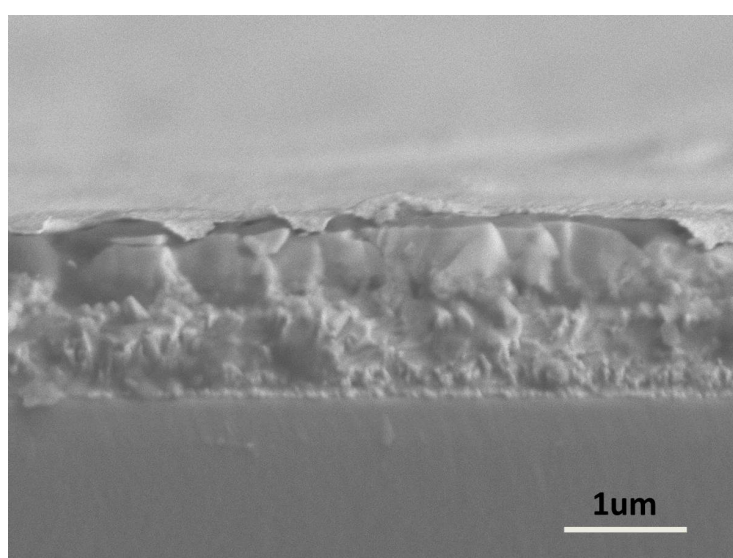


Fig. S3 Cross section image of device with PEO layer.

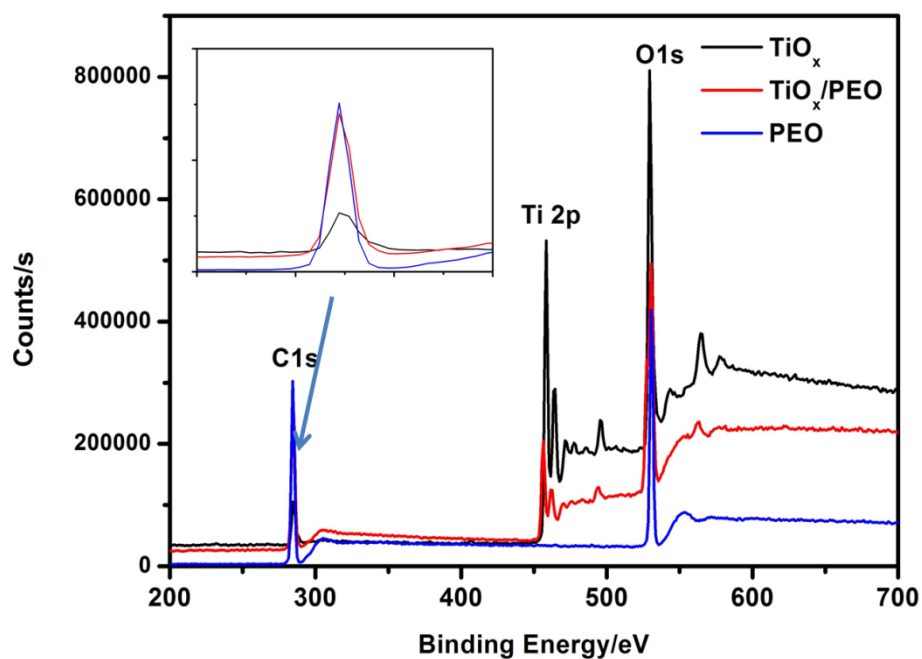


Fig. S4 Survey of the XPS result. Insert showed the C1s peak (at 284.8eV). The spectra was calibrated with respect to the C1s peak.

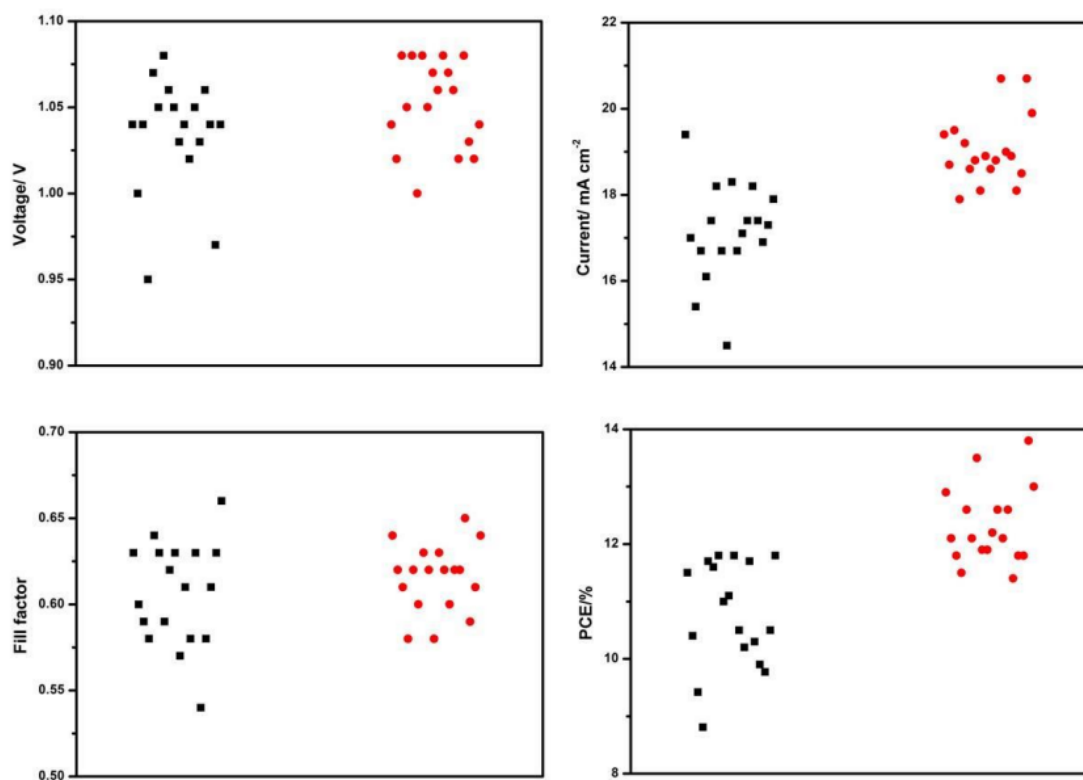


Fig. S5 Distribution of the photovoltaic parameters of the solar cells (V_{OC} , J_{SC} , FF and PCE): black squares for the devices with TiO_x as ETL and red dots for the devices with TiO_x/PEO as ETL.

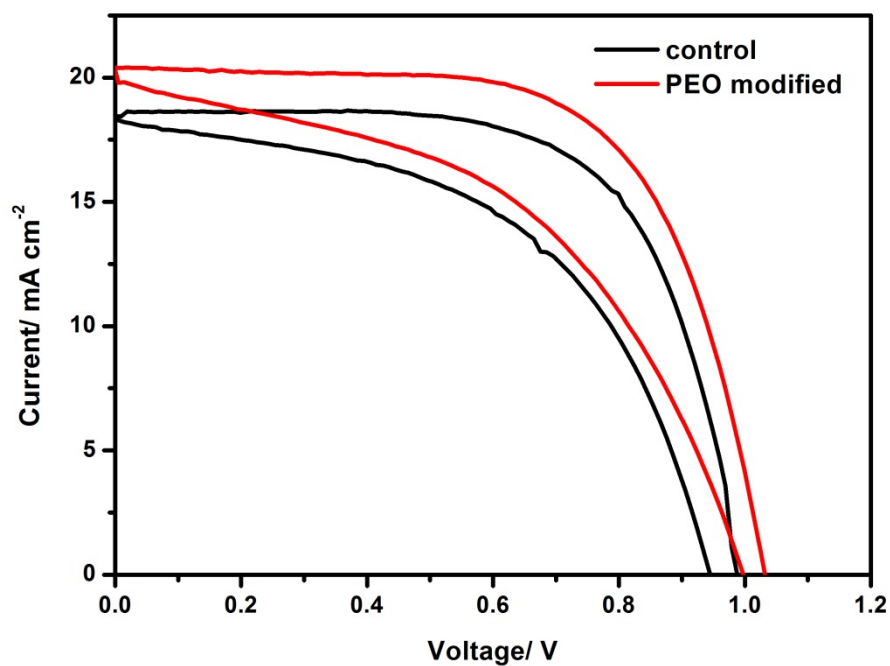


Fig. S6 *J-V* curves of PEO modified perovskite solar cell tested under forward and reverse scan.

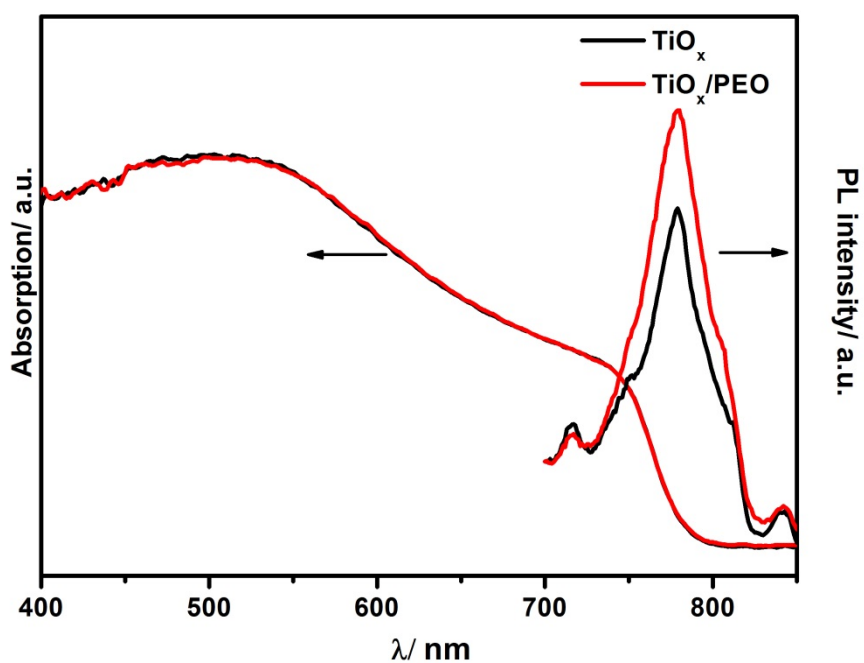


Fig. S7 UV-vis absorption and Steady-state PL spectra of films: FTO/TiO_x/MAPb_xCl_{3-x} (black curve) and FTO/TiO_x/PEO/MAPb_xCl_{3-x} (red curve).