

Electronic Supplementary Information

Titanate Hollow Nanospheres as Electron-transport Layer in Mesoscopic Perovskite Solar Cell with Enhanced Performance

Hui Wang ^a, Rui Jiang ^a, Meili Sun ^a, Xiong Yin ^{*a}, Yanjun Guo ^b, Meng He ^{*b,c} and
Leyu Wang ^{*a}

^a State Key Laboratory of Chemical Resource Engineering, Innovation Centre for Soft Matter Science and Engineering, Beijing University of Chemical Technology, Beijing 100029, P. R. China.

^b CAS Key Laboratory of Nanosystem and Hierarchical Fabrication, CAS Center for Excellence in Nanoscience, National Center for Nanoscience and Technology, Beijing 100190, P. R. China.

^c School of Physical Sciences, University of Chinese Academy of Sciences, Beijing 100049, P. R. China.

*E-mails: yinxiong@mail.buct.edu.cn ; lywang@mail.buct.edu.cn; mhe@nanoctr.cn

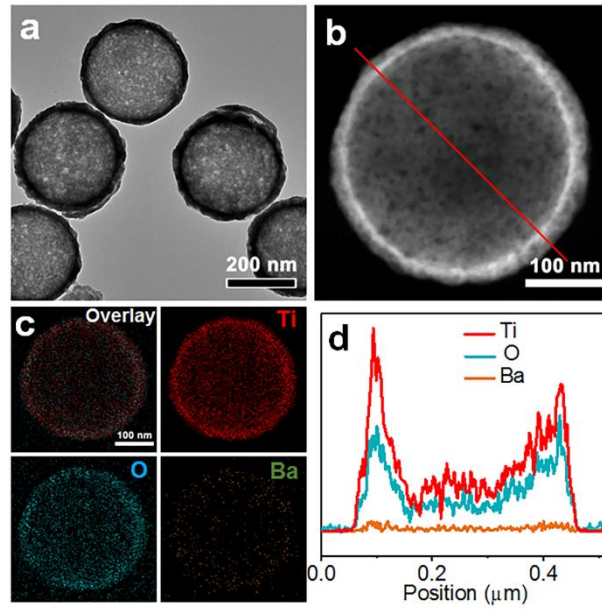


Figure S1. TEM image and mapping images for the Ti-Ba-O nanoshells.

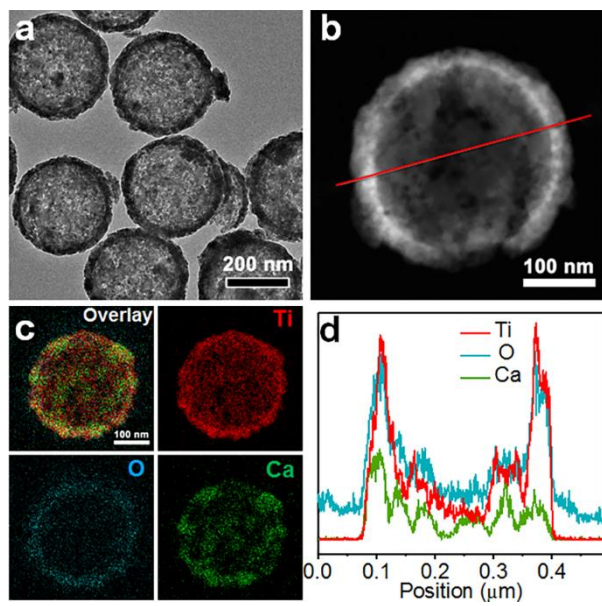


Figure S2. TEM image and mapping images for the Ti-Ca-O nanoshells.

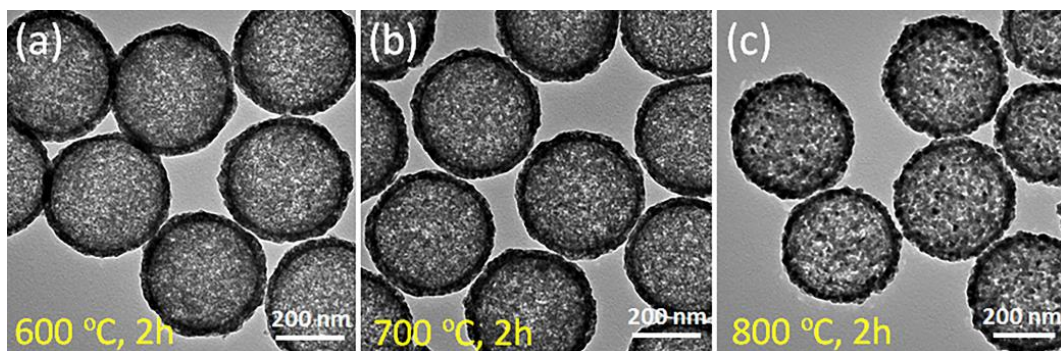


Figure S3. TEM images of Ti-Zn-O nanoshells sintered at different temperatures for 2 hours.

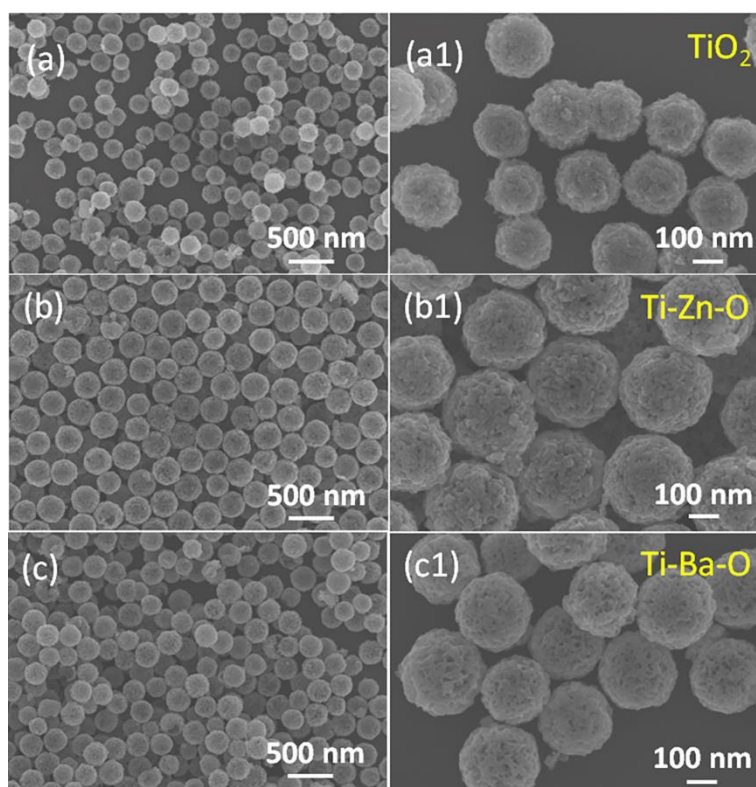


Figure S4. SEM images with different magnifications of the different nanoshells prepared at 800 °C for 2 hours: (a) TiO₂, (b) Ti-Zn-O and (c) Ti-Ba-O.

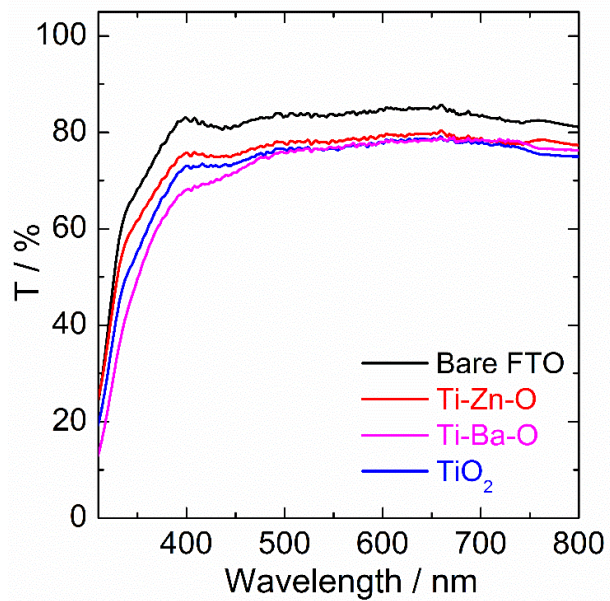


Figure S5. UV-Vis transmittance spectra of the bare FTO, TiO_2 , Ti-Zn-O and Ti-Ba-O shells covered FTO substrates.

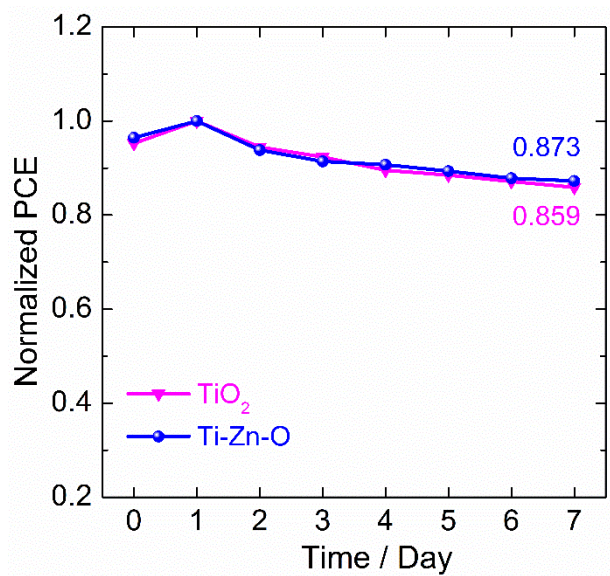


Figure S6. The variation of normalized PCE for perovskite solar cells with the time. The devices were unpackaged, and stored in a desiccator.

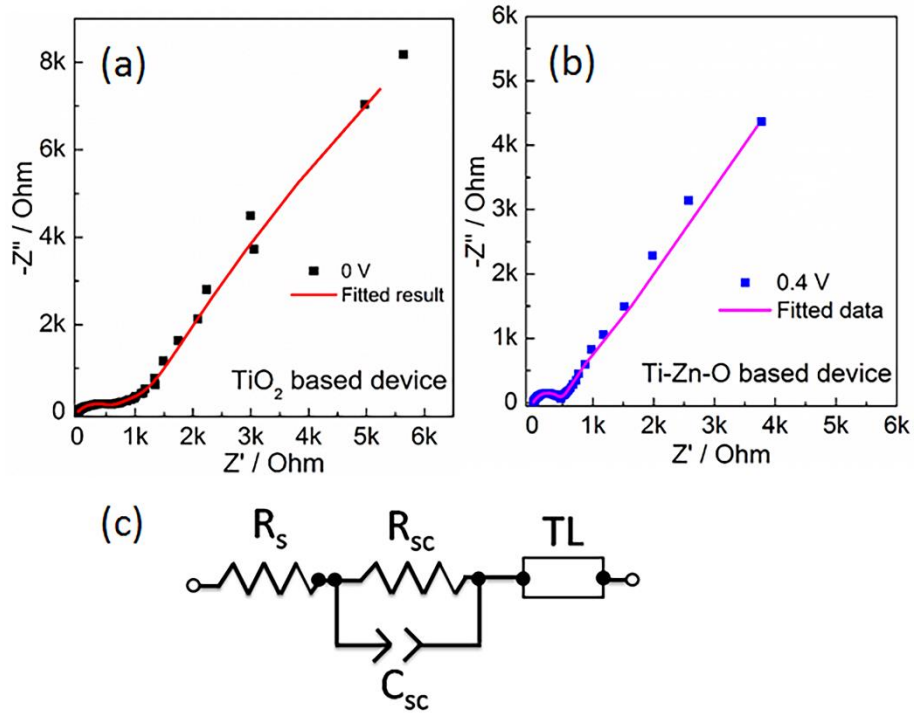


Figure S7. Nyquist plots of mesoscopic perovskite solar cells with (a) TiO_2 and (b) Ti-Zn-O hollow nanospheres ETLs, measured under light illumination with applied forward bias; symbols represent the experimental data and solid lines are the fitted curves; (c) The equivalent circuit used for fitting in the study.