Electronic Supporting Information

Ultrathin Efficient Perovskite Solar Cell Employing Periodic Structure of Composite Hole Conductor for Elevated Plasmonic Light Harvesting and Hole Collection

Mingzhu Long, †‡ Zefeng Chen, †‡ Tiankai Zhang, † Yubin Xiao, † Xiaoliang Zeng, ‡ Jian Chen, ‡ Keyou Yan, †*, Jianbin Xu †,*

1. Department of Electronic Engineering, The Chinese University of Hong Kong, Hong Kong, SAR, P. R. China
2. Shenzhen Institute of Advanced Technology, Chinese Academy of Science, Shenzhen, 518055, P. R. China
3. Instrumental Analysis and Research Center, Sun Yat-sen University, Guangzhou, 510275, P. R. China

Corresponding author: E-mail: yankeyou@gmail.com; jbxu@ee.cuhk.edu.hk
Figure S1 XRD patterns corresponding to the perovskite thin film in the device

As shown in the XRD, the perovskite thin film has excellent crystallite with prevalent peaks at 14.17°, 28.38° and 43.3°, which suggests that the film is well crystallized.

Figure S2 AFM images of 3D PMC HTM perovskite solar cell
Figure S3 Performance statistics for 3D PMC HTM
Figure S3 Ultraviolet photoelectron spectra (UPS) of HTMs on FTO

UPS spectra of the secondary electron cutoff energy onset and the HOMO energy level for the HTM are shown in Fig. S3. The electron secondary cutoff energy increases with the P3HT mixture. This is corresponding to the decreased $V_{oc}$ compared to the device with spiro as the HTM.