Supporting Information

Thermal Conductivity of Suspended Single Crystal $CH_3NH_3PbI_3$ Platelets at Room Temperature

Chao Shen,[a,e‡] Wenna Du,[b‡] Zhiyong Wu,[b] Jun Xing,[c] Son Tung Ha,[c] Qiuyu Shang,[d] Weigao Xu,[c] Qihua Xiong,[c] Xinfeng Liu,[b*] and Qing Zhang[d*]*

[a]State Key Laboratory for Superlattices and Microstructures, Institute of Semiconductors, Chinese Academy of Sciences, Beijing 100083, P. R. China

[b]Division of Photonics, CAS Key Laboratory of Standardization and Measurement for Nanotechnology, CAS Center for Excellence in Nanoscience, National Center for Nanoscience and Technology, Beijing 100190, P. R. China

[c]Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore 637371

[d]Department of Materials Science and Engineering, College of Engineering, Peking University, Beijing 100871, P. R. China

[e]College of Materials Science and Opto-Electronic Technology, University of Chinese Academy of Science, Beijing 100049, China

[*]Email address: q_zhang@pku.edu.cn, liuxf@nanoctr.cn and qihua@ntu.edu.sg

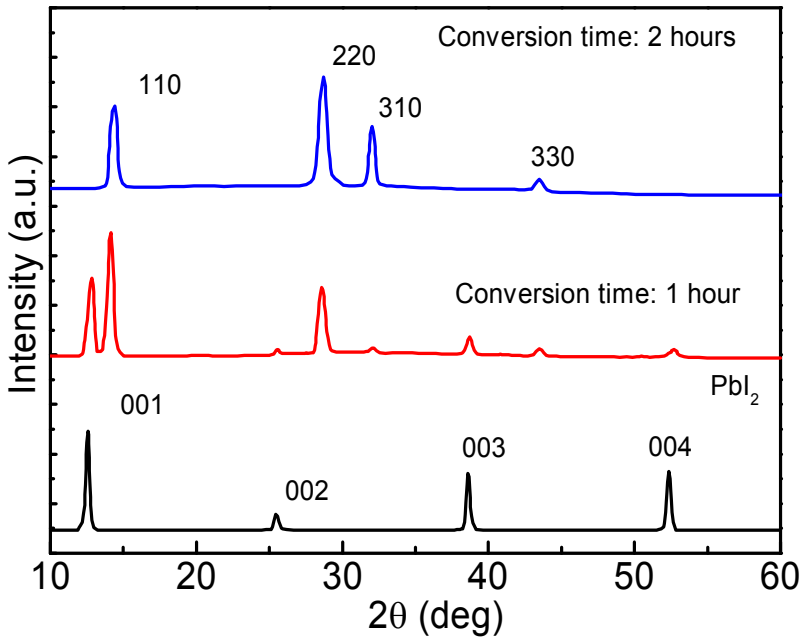

Fig. S1. Time evolution X-ray diffraction patterns of perovskite. It can be seen that a set of strong peaks at 12.62, 25.48, 38.58, and 52.28, assigned to 001, 002, 003, and 004 of the PbI_2 crystal growing on SiO_2/Si substrate, indicating high level of phase purity of hexagon crystal structure of PbI_2 with a highly oriented growth direction along the c-axis. XRD patterns are detailed accompanied by perovskite platelet evolution with different conversion time. During the perovskite conversion process (1h), corresponding peaks of both PbI_2 and $CH_3NH_3PbI_3$ could be obtained in XRD pattern at the PbI_2 and perovskite coexist stage. Peaks for PbI_2 platelets were still similar like the pattern of the initial stage. The perovskite have been converted, owning the characteristic peaks at 14.66°, 28.90°, 32.26°, and 43.65°, assigned to (110), (220), (310), and (330) for $CH_3NH_3PbI_3$ perovskite with a tetragonal crystal structure. With the advance of time, the PbI_2 peaks totally disappear at the conversion complete stage (2h in this work), and the pure perovskite were obtained with high crystallinity.

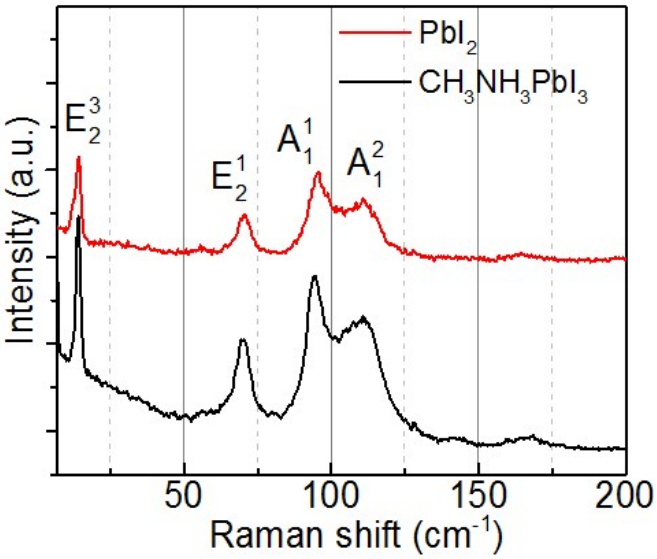

Fig. S2. Raman spectra of perovskite samples before (PbI_2) and after conversion ($CH_3NH_3PbI_3$). In both PbI_2 and perovskite nanoplatelets, Raman spectra have the peaks at 14 cm^{-1} assigned to E_2^3, at 70 cm^{-1} assigned to E_2^1, at 94 cm^{-1} assigned to A_1^1 and at 110 cm^{-1} assigned to A_1^2.

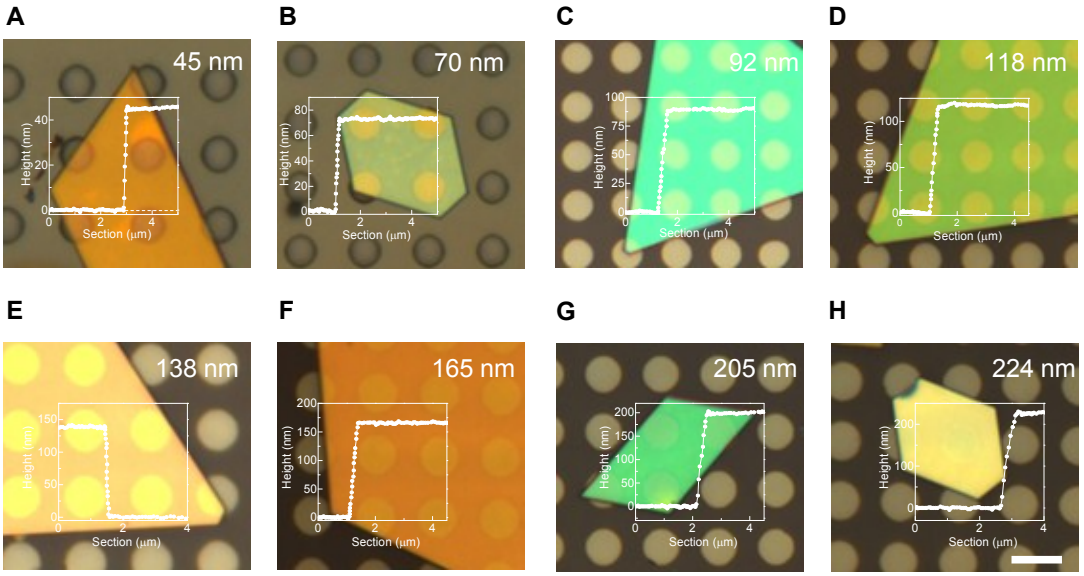

Fig. S3. (**A-H**) Optical images of PbI_2 platelet with different thickness of ~45 to 224 nm. The thickness of the platelet can be seen inset of the image and it is estimated using AFM. After conversion from PbI_2 to $CH_3NH_3PbI_3$, the thickness of perovskite platelets are of ~80 to 400 nm. All the diameter of hole on the SiO_2/Si substrate is ~3 μm. The $CH_3NH_3PbI_3$ platelet is suspended on these holes for PL measurement. Using the equation derived in the main text, we calculate the thermal conductivity of corresponding platelet with different thickness and these values are expressed in Figure 5.