Supporting Information

Thermal Conductivity of Suspended Single Crystal CH$_3$NH$_3$PbI$_3$

Platelets at Room Temperature

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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$_3$NH$_3$PbI$_3$ 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$_3$NH$_3$PbI$_3$ 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$_3$NH$_3$PbI$_3$). 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$_3$NH$_3$PbI$_3$, 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$_3$NH$_3$PbI$_3$ 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.