Supplementary Information

Piezoelectric Properties of CH₃NH₃PbI₃ Perovskite Thin Films and Applications for Piezoelectric Generators

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Fig. S1 XRD patterns of the MAPbI$_3$ films annealed at 100 °C for different times under ambient condition.
Fig. S2  AES depth-profile for the Pb, I, and C elemental distribution of the MAPbI₃ films deposited onto the Au (100 nm)/Ti (10nm)/glass substrate.
Fig. S3  Absorption spectra of the 500 nm-thick MAPbI₃ films before and after annealing at 100 °C for 1h. The MAPbI₃ films were deposited onto the FTO/glass substrate.
Fig. S4  Grain size vs. annealing time under an air atmosphere at 100 °C. The grain size of the MAPbI₃ films was determined using Scherrer formula via XRD.
Fig. S5  The $d_{33}$ piezoelectric coefficient of the MAPbI$_3$ films measured through the $V_{ac}$ dependent piezoresponse measurements. The results were obtained by averaging the 25 measurements.
Fig. S6  (a) Schematic structure of the piezoelectric generator, (b) Photograph of the actual piezoelectric generator, and (c) Optical image of the measurement setup, providing push and release motions of the load onto the MAPbI$_3$ piezoelectric generator.
Fig. S7  Piezoelectric potential generated from the MAPbI$_3$ perovskite thin films calculated using COMSOL Multiphysics software. The thickness of the active film layer is 0.5 μm, the PET substrates (top and bottom) of 170 μm, and PDMS layer of 20 μm. The $d_{33}$ of the film was set to 5.12 pm/V. The pressure (0.5 MPa) was applied normal to the surface of the MAPbI$_3$ thin films. The simulated colors in the figure were only indicated in the MAPbI$_3$ thin films.