

Supporting Information

Halide exchange in $(\text{CIEA})_2\text{PbI}_4$ and its effect on the structural and electronic properties of perovskite layers

Linfei Yang^a, Xiaoyan Gan^{a*}, Gang Zhao^b, Qiang Huang^a, JianHua Liao^c, Changsheng Wang^c, Hanxing Liu^d

- a. Sanya Science and Education Innovation Park, Wuhan University of Technology, Sanya 572024, China.
- b. Hubei Key Laboratory of Mechanical Transmission and Manufacturing Engineering, Wuhan University of Science and Technology, Wuhan 430081, China
- c. School of Materials Science and Engineering, Wuhan University of Technology, 122 Luoshi Road, Wuhan 430070, China.
- d. International School of Materials Science and Engineering, Wuhan University of Technology, 122 Luoshi Road, Wuhan 430070, China.

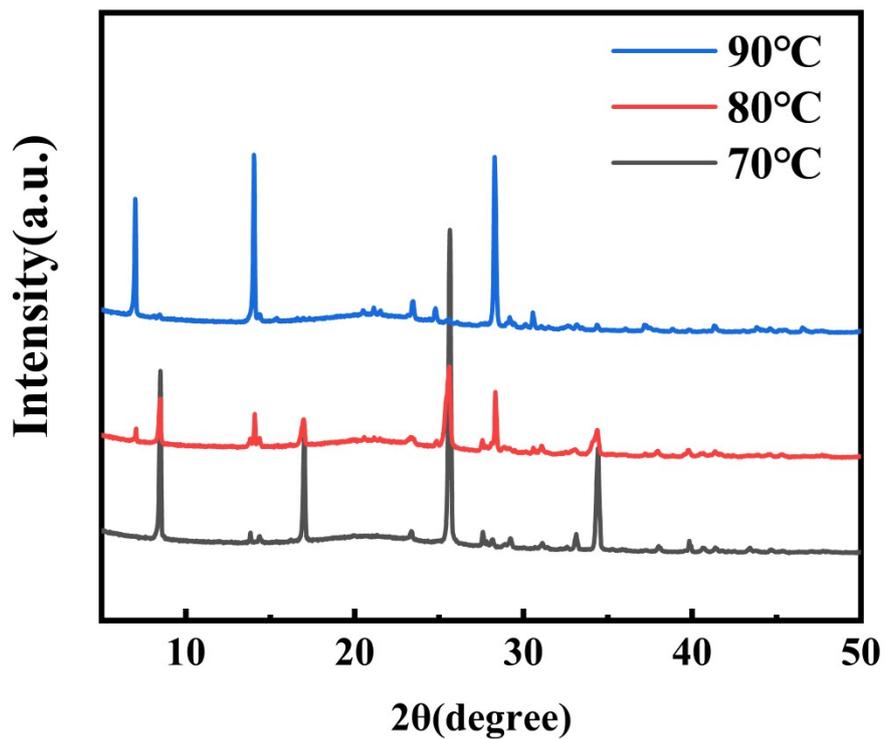


Fig. S1 XRD patterns of (CIEA)₂PbI₄ after high-temperature treatment at different temperatures for 6 h.

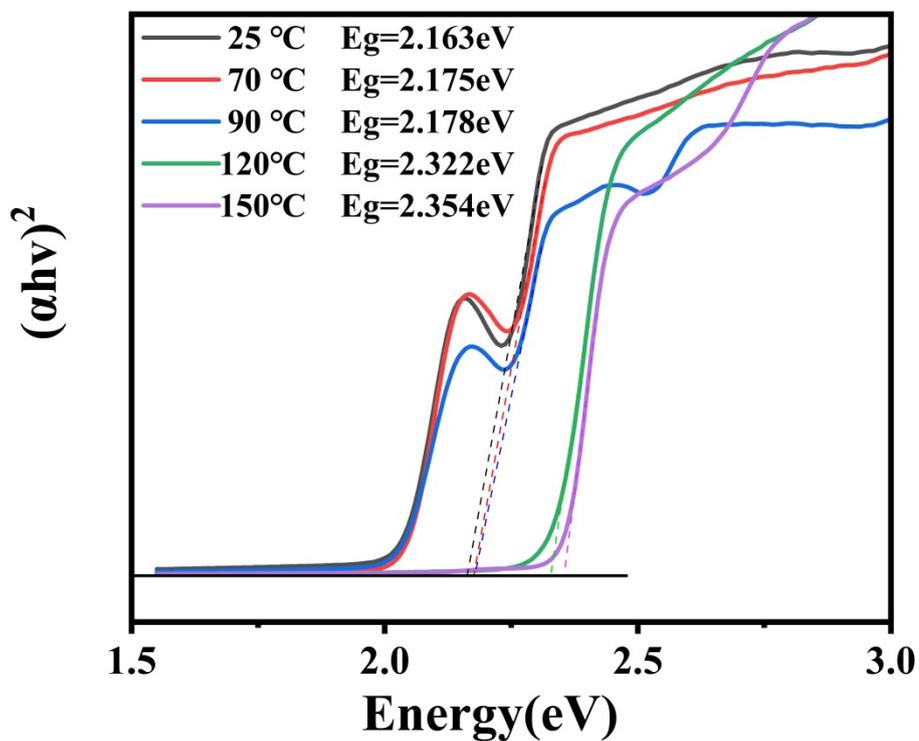


Fig. S2 Tauc plots of (CIEA)₂PbI₄ at different temperatures.

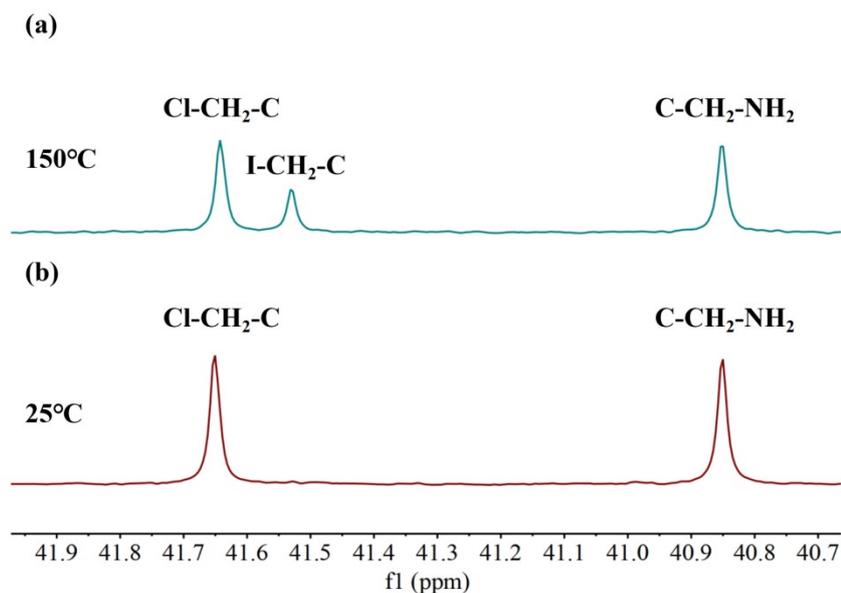


Fig. S3 ^{13}C nuclear magnetic resonance (^{13}C NMR) spectra of $(\text{ClEA})_2\text{PbI}_4$ at (a) 150°C and (b) 25°C .

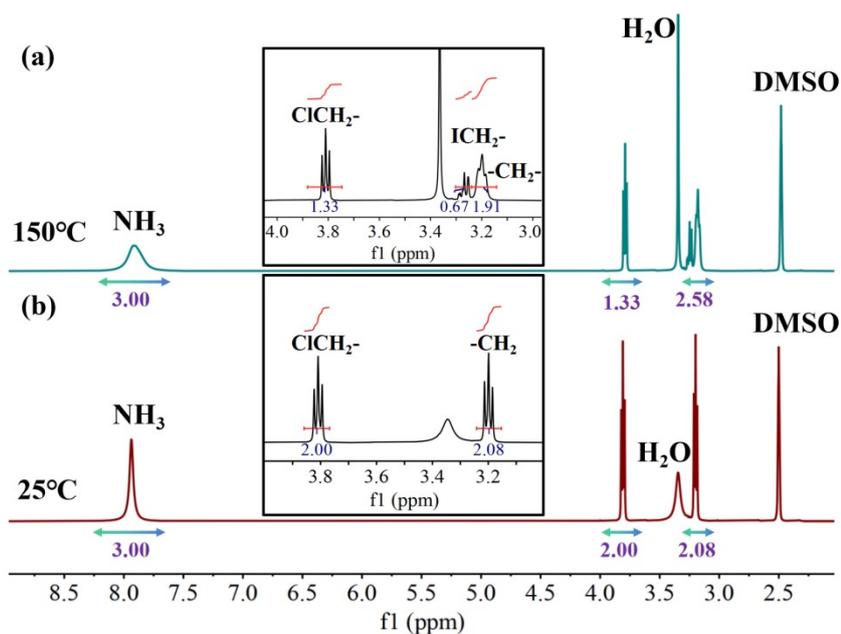


Fig. S4 ^1H nuclear magnetic resonance (^1H NMR) spectra of $(\text{ClEA})_2\text{PbI}_4$ at (a) 150°C and (b) 25°C .

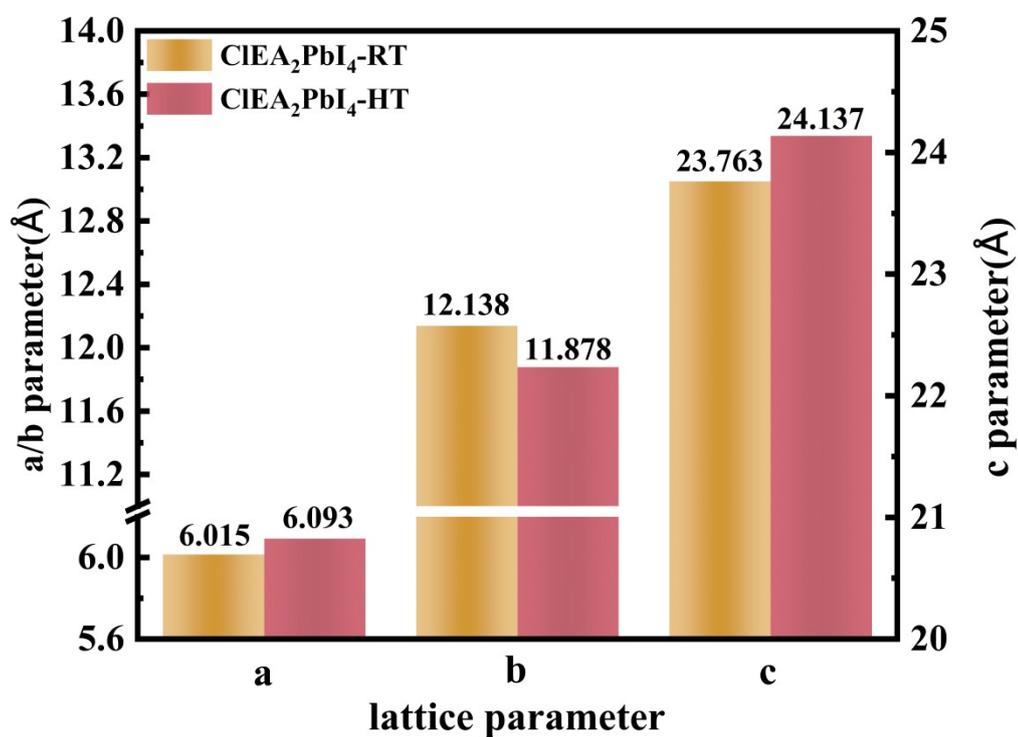


Fig. S5 Cell parameters a, b and c of (CIEA)₂PbI₄ at RT and HT (with heat treatment at 150°C).

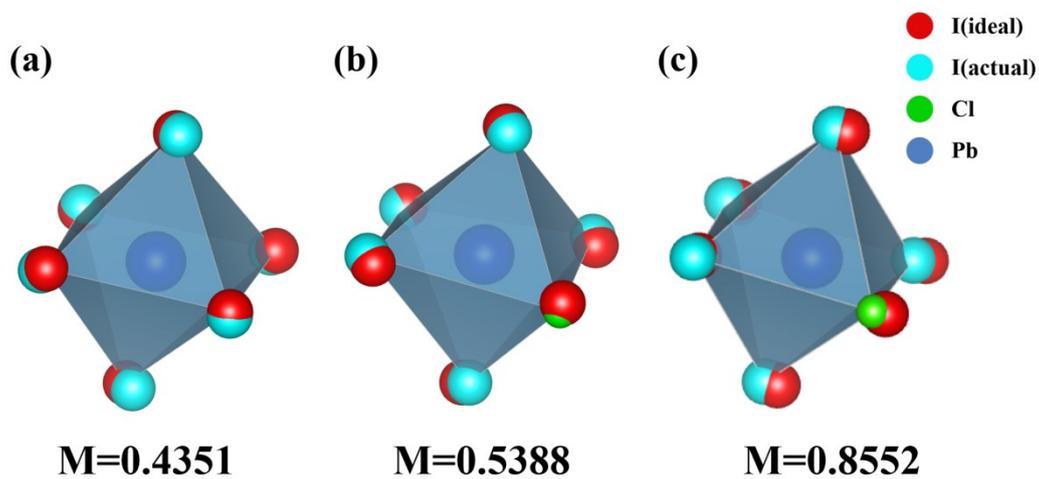


Fig. S6 Distortion models of single octahedra in (a) (CIEA)₂PbI₄; (b, c) (Cl_{1.33}I_{0.66})EA₂Pb(I_{3.33}Cl_{0.66}).