Electronic supporting information for paper

**Pyrroolidinium containing perovskites of thermal stability and water resistance for photovoltaics**

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**Fig S1.** P-XRD of PyPbI\textsubscript{3}.

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![Graph of X-ray diffraction pattern for PyPbI\textsubscript{3}](image)
Fig S2. H-NMR result of the PyPbI₃ product.

Fig S3. TGA curve of PyPbI₃. The product started weight dropping at 218°C, which indicates the original structure of PyPbI₃ remains stable even beyond 200°C. This is much higher than the phase transformation temperature of MAPbI₃, which is only around 55°C. The weight loss then continues throughout the rest of the curve till 600 °C, where the PyPbI₃ decomposes completely.
Fig S5. The FTIR spectra of the PyPbI\(_3\) thin film. No sharp bands appear at \(\mu<840\) cm\(^{-1}\) or \(\mu>3500\) cm\(^{-1}\), which means there is no water exist in the material. This is not surprising, considering that the PyPbI\(_3\) product was annealed at 120\(^\circ\)C to form the thin film. All the other bands in the spectra can be assigned unambiguously to the pyrrolidinium cations. Moreover, their broadness is a clear indication of their orientational disorder, which was also confirmed by our single crystal XRD results. Obviously, the vibrations of the Pb-I skeleton are not visible in the explored wavenumber range.

Fig S4. Crystal structure of (C\(_4\)H\(_8\)NH\(_2\))PbI\(_3\); lead yellow, iodine purple, carbon black, nitrogen blue and hydrogen grey. Reprinted with permission from ref. 26.