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Characterize the ion-migration of organic-based lead iodide perovskite light-emitting diode via capacitance response

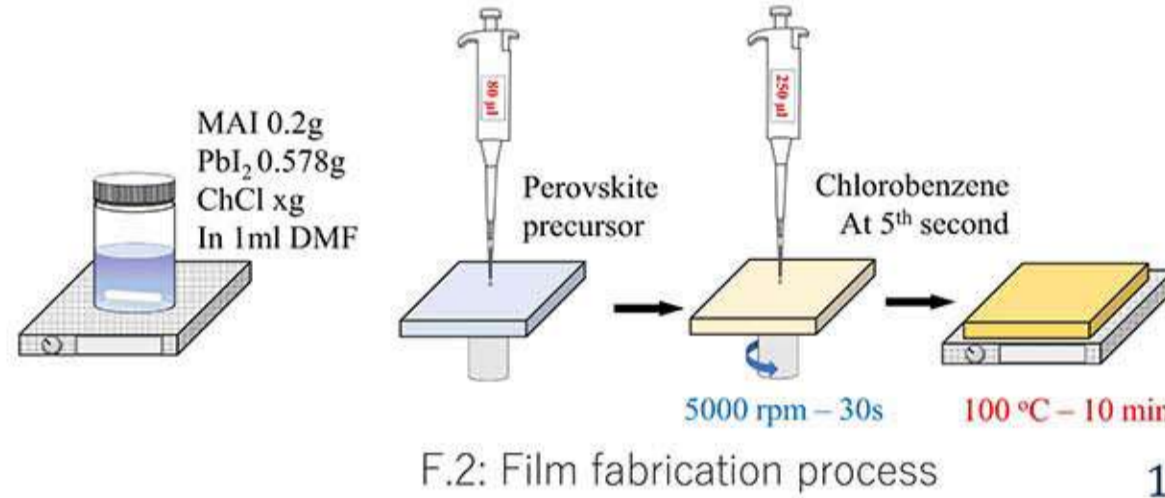
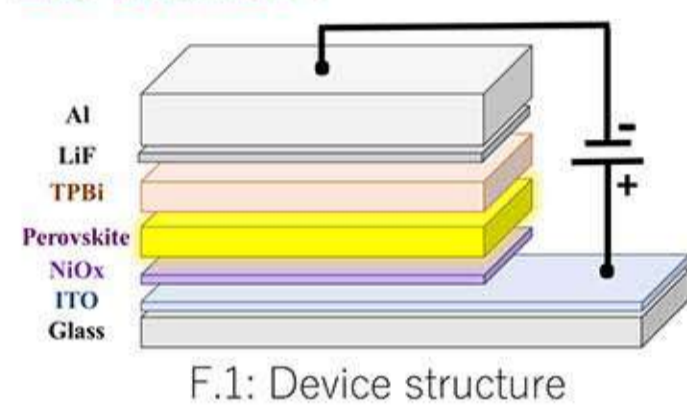
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ABSTRACT - Here in, the hysteresis behaviors of methylammonium lead triiodide (MAPbI₃) perovskite light-emitting diodes (PeLEDs) is minimized by incorporation of choline chloride (ChCl). By studying the variation of capacitance by time, the activation energy of ion migration (E_a) is determined and the hidden mechanism of the additive is clarified and the influence of halide in PeLEDs are verified.

EXPERIMENT



Formula

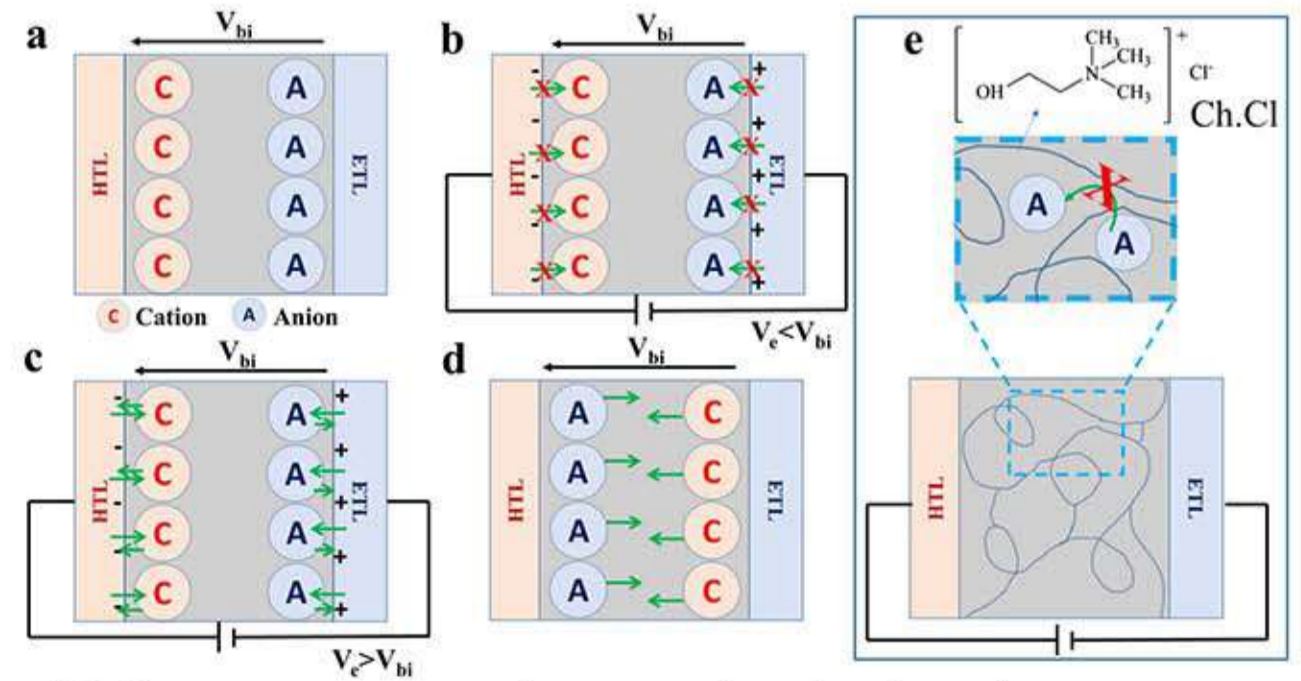
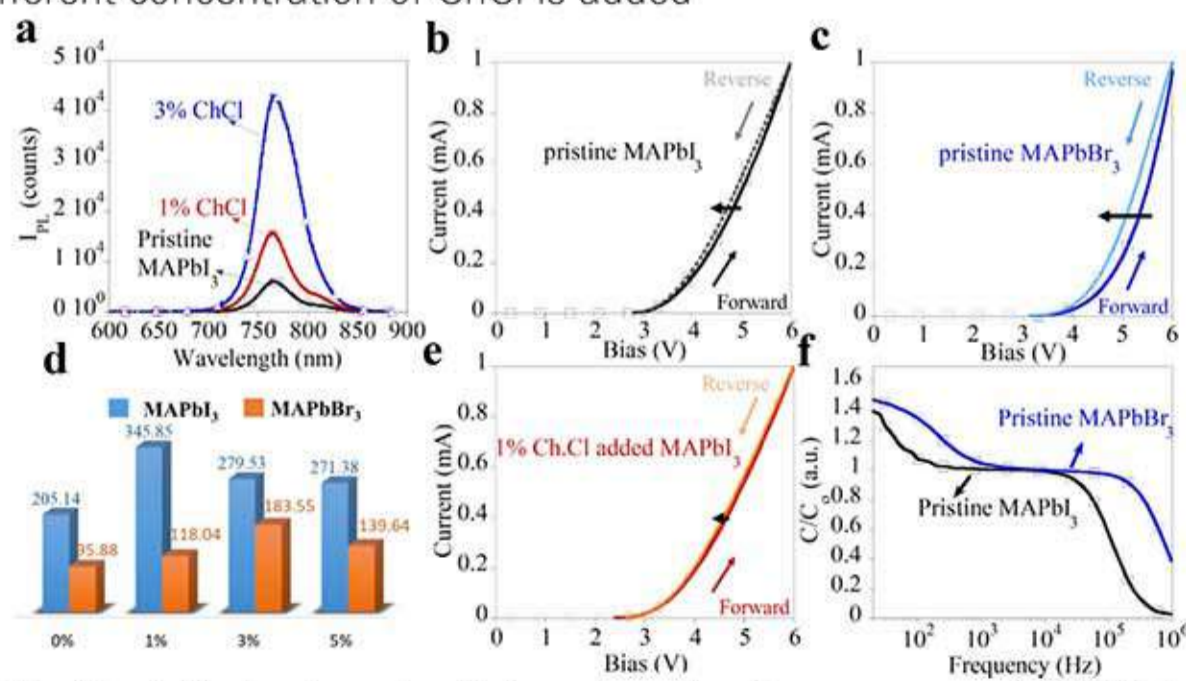
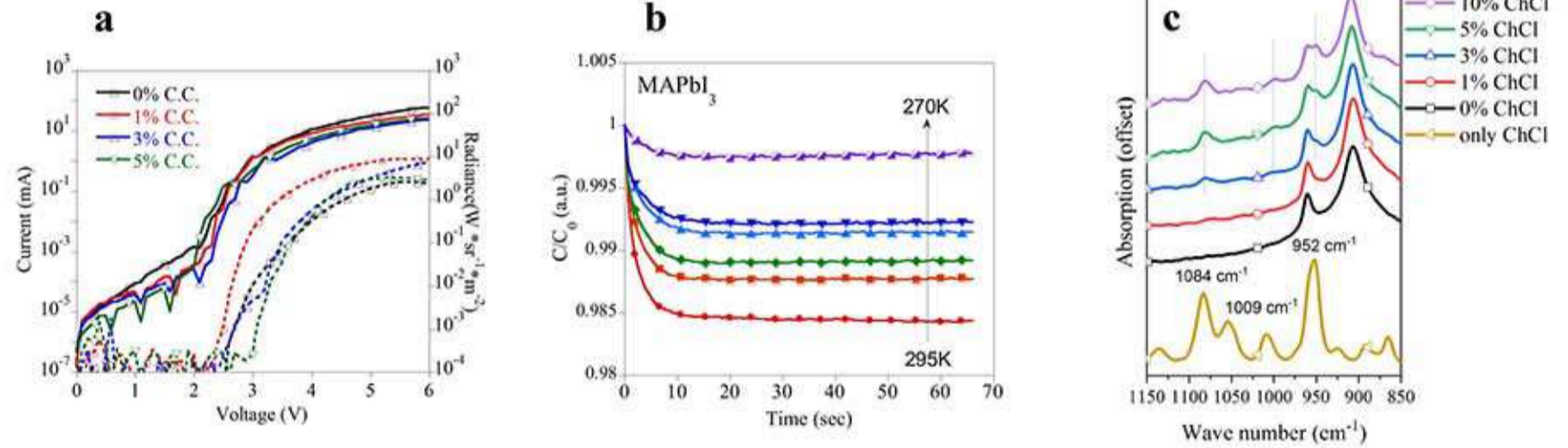
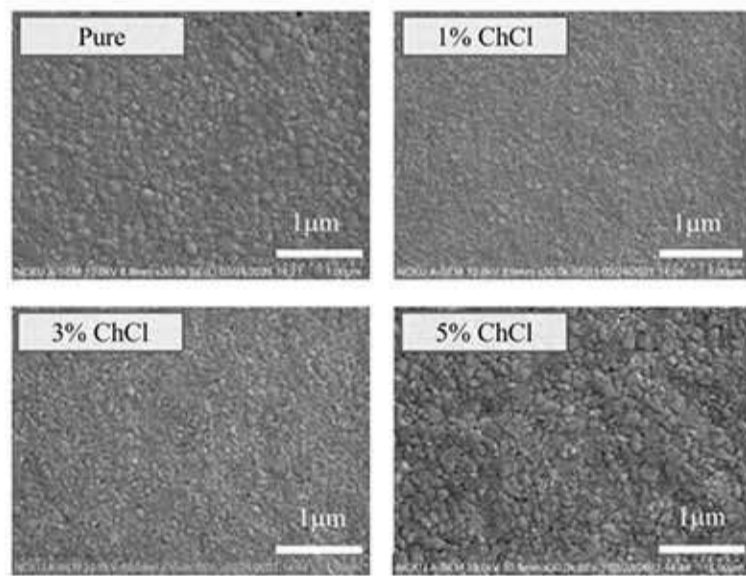
$$C(t) = C(\infty) + \Delta C e^{-\frac{t}{\tau}}$$

$$\tau = \frac{k_B T \epsilon_0 \epsilon}{q^2 D N} \quad D = D_0 e^{-\frac{E_a}{k_B T}}$$

$$C(\tau) = C(\infty) + 0.368 \Delta C$$

$$1000 \ln\left(\frac{\tau}{T}\right) = 1000 \ln\left(\frac{K_B \epsilon_0 \epsilon}{q^2 N D_0}\right) + \frac{1000 E_a}{K_B T}$$

RESULTS



CONCLUSION - By studying hysteresis and the capacitance, we are successfully study the operation mechanism of MAPbI₃ and MAPbBr₃ perovskite LEDs under the co-operation of ChCl. The results showed that the ChCl is efficiency ion migration suppressor and the migration of iodide is not serious as bromide in similar examine condition.

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