

Supporting information

Quantifying Electrochemical Losses in Perovskite Solar cells

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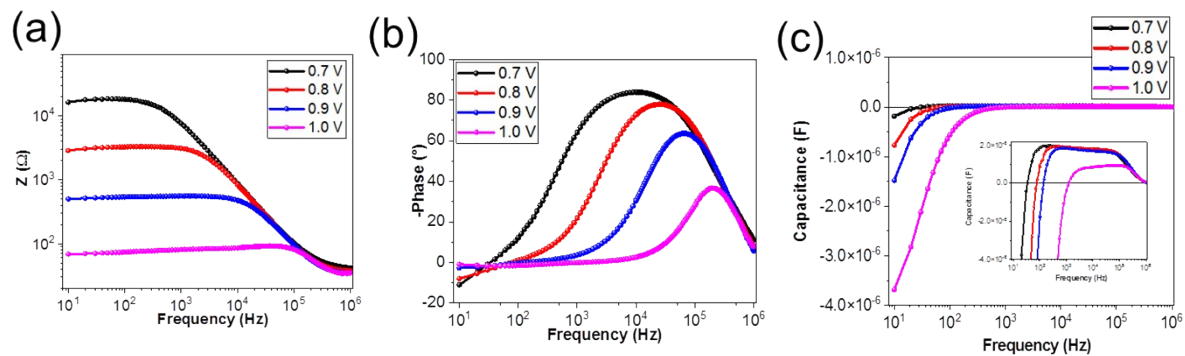


Figure S1. (a) The Z versus frequency; (b) the phase versus frequency; (c) the capacitance versus frequency, where the inset shows the negative capacitance in the low frequency regime in the dark at DC biases of 0.7 V, 0.8 V, 0.9 V, and 1.0 V, respectively.

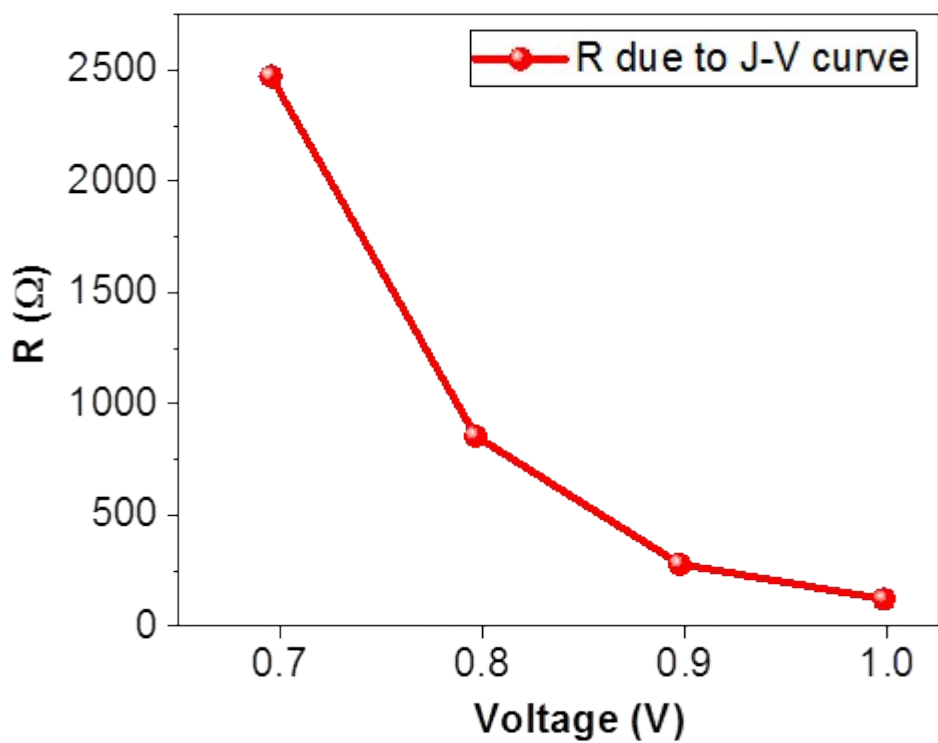


Figure S2. Plot R from the J-V curve versus voltage.

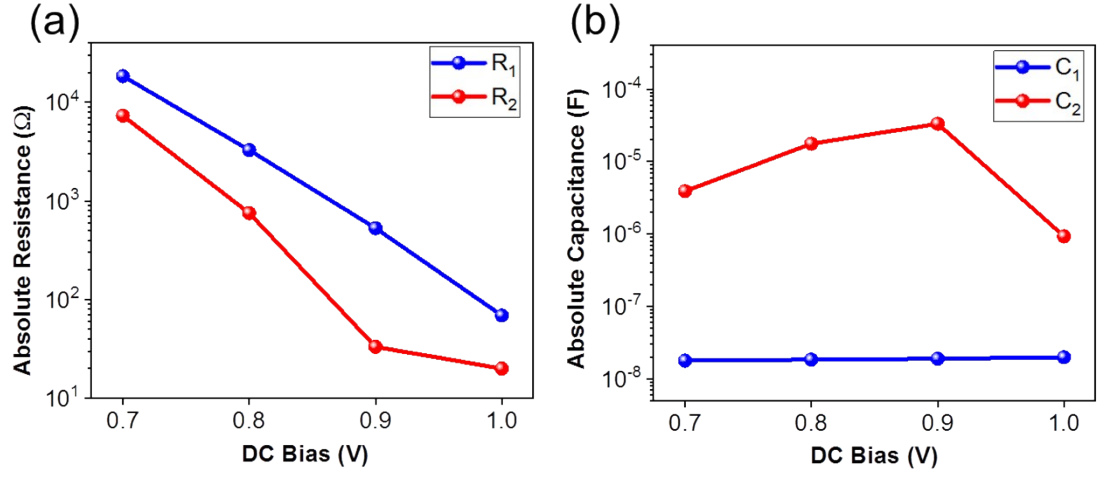


Figure S3. (a) Plot R_1 , R_2 from ECM versus applied external voltage, (b) Plot C_1 , C_2 from ECM versus applied external voltage.

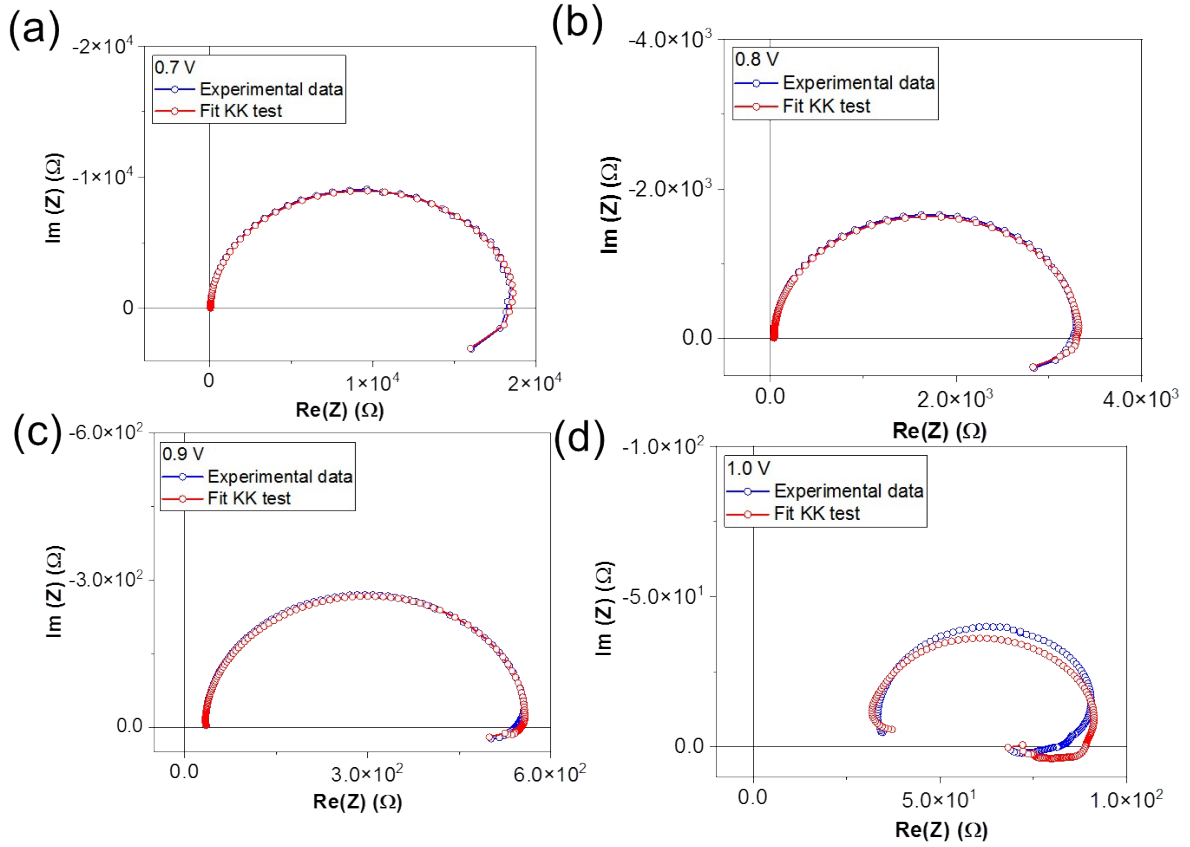


Figure S4. The Nyquist plot of the experimental data (blue) as well as the fit (red) from the KK check using 20 RC elements with ratio data point of 0.13 in the dark at DC bias of, (a) 0.7 V, (b) 0.8 V, (c) 0.9 V, and (d) 1.0 V, respectively.

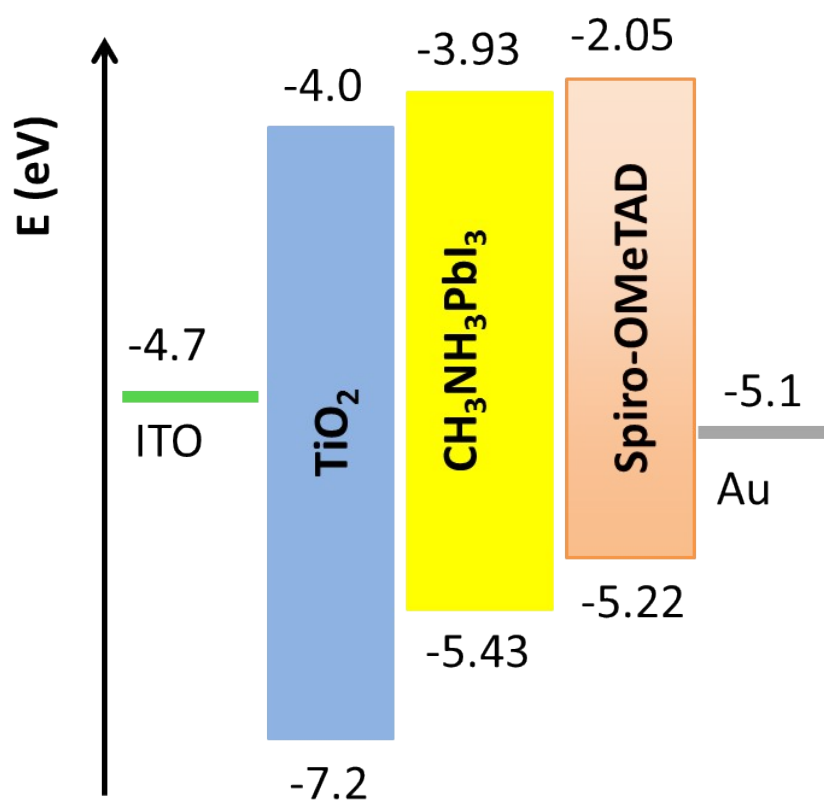


Figure S5. Depicts the energy band diagram of the device.^{1,2}

REFERENCES

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- 2 W.J. Scheideler, N. Rolston, O. Zhao, J. Zhang and R.H. Dauskardt, *Adv. Energy Mater.*, 2019, **1803600**, 1-8.