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Resolving local voltage variations in opto-electronic devices with Kelvin probe force microscopy ELIZABETH TENNYSON, University of Maryland College Park - Department of Materials Science and Engineering, JOSEPH GARRETT, University of Maryland College Park - Department of Physics, JEREMY MUNDAY, University of Maryland College Park - Department of Electrical and Computer, MARINA LEITE, University of Maryland College Park - Department of Materials Science and Engineering — We employ illuminated Kelvin probe force microscopy (KPFM) to spatially resolve the open-circuit voltage (V_{oc}) of optoelectronic devices with nanoscale spatial resolution, >5 orders of magnitude better than previous methods. In illuminated-KPFM, we measure the difference in work function between the sample surface and the probe, termed the contact potential difference (CPD). By grounding the bottom contact of the solar cell to the AFM probe, the difference between the illuminated and the dark signals is proportional to quasi-Fermi level splitting and, therefore, the V_{oc}. We apply our scanning probe technique to a variety of solar cell materials, including polycrystalline CIGS, where we resolve local variations in V_{oc} >150 mV [1]. We use heterodyne-KPFM (where we map 1 μm^2 in 16 seconds) to probe hybrid perovskites solar cells, and quantify in real-time the voltage changes upon material relaxation after illumination. This metrology yields new insights into the local electrical properties of solar cells, and can be expanded to any optoelectronic device. [1] E.M. Tennyson et al., Adv. Energy Mat., **5** (2015) in press, front cover.

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