1	Supporting information for
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4	Nanoscale Imaging and Spectroscopy of Band Gap and defects in
5	Polycrystalline Photovoltaic Devices
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54 Figure S1. Comparison of PTIR and topography profiles of the cross-sectional lamella sample (a) Topography image (same as figure 2c in the main text) and (b) PTIR image at 1.45 eV (same as fig 2c). c) Line profiles of the height (black) and the PTIR intensity (red) corresponding to the green dotted line in panel a. The shaded gray identifies the CdS, ITO and glass portions of the sample. d) Line profiles of the height (black) and the PTIR intensity (red) corresponding to the purple dotted line in panel a. Panel c shows that although the topography is relatively smooth (2% variation with the exclusion of the sample edges) the PTIR signal changes several fold (800%) indicating a local compositional/stoichiometric variation.



Figure S2. AFM topography of the in-plane CdTe lamella before and after  $Ar^+$  etching. (a) AFM Topography image obtained simultaneously with the PTIR image in figure 3d. (b) AFM Topography image obtained of the same area after  $Ar^+$  etching reveal the grain pattern. The pixel sizes are 15 nm × 15 nm. (c) PTIR spectra of sub-band gap absorption from two spots in the color-coded locations denoted in d and a single crystalline CdTe lamella sample. (d) PTIR image at 1.25 eV. The pixel sizes are 15 nm × 15 nm in PTIR images.





Figure S3. NSOM line profiles of the in-plane CdTe lamella sample. Line scan profiles extracted from the red
dotted line in Fig.4a. The dt-NSOM line scan profiles clearly show the absence of correlation with surface topography
and an uncorrelated absorption pattern at different energies.



90 Figure S4. (a) Topography image, and dt-NSOM images at (b) 1.46 eV, (c) 1.53 eV, (d) 1.53 eV with changing color
91 axis scaling to highlight absorption in CdTe layer. The dt-NSOM pixel sizes are 19.5 nm × 19.5 nm.



- 99 Figure S5. STEM/EDX maps for two areas in proximity of the p-n junction. TEM images (a, d), sulfur (b, e) and 100 chlorine (c, f)) maps obtained by STEM/EDX analysis. Line profiles (g, h) showing the distribution of sulfur and
- 101 chlorine along the red dot lines in panels a, d.