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Importance of Depletion Width on Charge Transport and Interfacial Recombination in Extremely Thin Absorber Solar Cells MICHAEL EDLEY, TREAVOR JONES, JASON BAXTER, Drexel University — The dynamics of charge carrier transport and recombination and their dependence on physical and electrochemical length scales in extremely thin absorber (ETA) solar cells is vital to cell design. We used J-V characterization, transient photocurrent / photovoltage, and electrochemical impedance spectroscopy to study electron transport and interfacial recombination in ETA cell. ETA cells were composed of ZnO nanowires coated with an ultrathin (5 nm) CdS buffer layer and CdSe absorbers with thicknesses of 10 – 40 nm, with polysulfide electrolyte. In thinner absorbers near short circuit, the depletion region can extend radially into the nanowire, inhibiting interfacial recombination rate. However, depleting the periphery of the nanowire reduces the cross sectional area for charge transport, resulting in longer characteristic collection times. Thicker absorbers suffered more significant bias-dependent collection, and we conclude that slight radial penetration of the depletion region into the nanowires enhances charge collection. This work highlights the importance of considering the impact of depletion width on charge transport and interfacial recombination in the design of liquid junction, semiconductor-sensitized solar cells.

Michael Edley
Drexel University

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