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Energetic Resolution of State Filling by Surface Photovoltage Spectroscopy in Solar Energy Materials CONNER CASTLE, BRANDON YOST, SCOTT CUSHING, NIANQIANG WU, ALAN BRISTOW, West Virginia Univ — Single semiconductors rarely possess the balance of spectral coverage and carrier lifetimes necessary for efficient photovoltaics or photocatalysis. This imbalance is commonly overcome by doping or heterostructuring, but subsequent introduction of defect and interface states weaken performance while being difficult to detect. Herein, we show that the surface potential formed by the differing charge diffusion rates of excited electrons and holes can be detected by surface photovoltage spectroscopy (SPV). SPV allows the excitation-energy dependent filling and lifetime of interface states, defect states, and band gap transitions to be separated, and is applied to characterize the improvement in electron and hole diffusion in a CdS@Au@TiO2 heterostructures while identifying losses from interface and defect states. The results show that Au can increase carrier transport between the two semiconductors while passivating surface states, improving the overall solar energy conversion efficiency.

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