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Imaging Long-Range Carrier Diffusion Across Grains in Polycrystalline CdTe[1] KIRSTIN ALBERI, BRIAN FLUEGEL, HELIO MOUTINHO, RAMESH DHERE, JIAN LI, ANGELO MASCARENHAS, National Renewable Energy Laboratory — The use of polycrystalline semiconductors in electronic devices enables low cost fabrication on large area substrates. Understanding the extent to which structural defects and impurities influence carrier transport in these materials is increasingly important as device performance is maximized, but most conventional characterization techniques often cannot directly probe their effects. We have applied a novel photoluminescence imaging technique to directly observe carrier diffusion in the presence of grain boundaries and impurities in poly-CdTe films. Our results show that the grain boundaries in this material are relatively transparent to free carrier and exciton diffusion as compared to poly-GaAs. Furthermore, a network of inhomogeneously distributed impurity states is found to mediate hole transport across multiple grains to distances greater than 10 microns from the point of photogeneration. These results underscore the importance of controlling the concentration and distribution of impurity states in poly-CdTe thin film solar cells.

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Kirstin Alberi
National Renewable Energy Laboratory

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