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Carrier dynamics and the role of grain boundaries in polycrystalline PbS films KATERYNA KUSHNIR, KEFAN CHEN, PRATAP RAO, LYUBOV TITOVA, Worchester Polytechnic Institute — Polycrystalline lead sulfide (PbS) films are promising materials for use in highly ef?cient solar cells. We have used a time-resolved terahertz spectroscopy to study microscopic photoconductivity in thin polycrystalline PbS films. These films were synthesized using a chemical bath containing lead, sulfur precursors and reducing agent (hydroxylamine hydrochloride). The concentration of the hydroxylamine hydrochloride for all preparations have been varied from 0% to 200%. The deposition took place at room temperature. These sets of samples which were deposited, changed in a film morphology from 300 nm thick parse film composed of small crystallites to the densely packed 800 nm with large cubic grains. We find that while the lifetime of photoexcited carriers in all studied films is comparable to carrier lifetime in single crystalline silicon, grain boundaries significantly impede long-range conductivity even in dense films, suggesting that chemically modifying the surfaces of PbS grains is necessary to achieve efficient extraction of photoexcited carriers.

Kateryna Kushnir
Worchester Polytechnic Institute

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