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The lifetime recovery puzzle in intermediate band materials: A new experimental approach MARK WINKLER, Massachusetts Institute of Technology, DANIEL RECHT, JACOB KRICH, MICHAEL AZIZ, Harvard University, TONIO BUONASSISI, Massachusetts Institute of Technology — We have recently observed that deep-level impurities in silicon – such as the chalcogens S and Se – can drive an insulator-to-metal transition. The existence of this transition has potential ramifications for the development of intermediate band (IB) solar cells, and significant progress has recently been made toward explaining the origin of this transition. Recently, however, theoretical disagreement has arisen regarding whether impurity concentrations beyond the insulator-to-metal transition should result in increased non-radiative recombination rates or instead yield "lifetime recovery." Very few measurements of carrier lifetime in IB-candidates have been reported that could help clarify this issue, which has important impacts on the selection of IB-materials and the design of IB solar cells. We have developed a technique based on transient optical absorption to measure the trapping rate of the intermediate states and will discuss the results of these measurements in the hyperdoped silicon system (Si doped with chalcogens to concentration $>10^{20}\text{cm}^{-3}$). We will also discuss the impact of these measurements on the current theoretical disagreement.

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