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Recombination lifetimes in laser hyperdoped Si layers measured via microwave photoconductive decay JAY MATHEWS, US Army ARDEC - Benét Laboratories, DAVID HUTCHINSON, RYAN MCAVOY, Rensselaer Polytechnic Institute, MARK WINKLER, Massachusetts Institute of Technology, DANIEL RECHT, AUSTIN AKEY, Harvard University, JONATHAN MAILOA, Massachusetts Institute of Technology, MICHAEL AZIZ, Harvard University, TONIO BUONASSISI, Massachusetts Institute of Technology, PETER PERSANS, Rensselaer Polytechnic Institute, JEFFREY WARRENDER, US Army ARDEC - Benét Laboratories — Silicon hyperdoped with impurities via ion implantation followed by pulsed laser melting has attracted much attention lately due to potential for forming an intermediate band. Such materials have shown significant optical absorption well below the band gap of Si and are being explored for applications in photovoltaics and infrared detection. However, while optical absorption can be increased, high dopant concentration generally leads to a substantial decrease in recombination lifetime, which can detrimentally affect the performance of detectors and solar cells. In this work, we use microwave photoconductive decay (μ-PCD) to explore the transient behavior of Si hyperdoped with S at various levels. Excitation is achieved via a pulsed Nd:YAG laser at 355 nm (FWHM $\sim$ 5 ns), ensuring that carriers are generated only in the hyperdoped region. Decay times were found to decrease monotonically with increasing S concentration, and the highest concentrations do not show measureable photoconductivity, which could indicate unacceptably low lifetimes. Additional μ-PCD measurements are presented on Si hyperdoped with Au, which are promising despite the fact that Au is typically a "lifetime killer," as well as Si hyperdoped with Ti, which has been previously shown to exhibit lifetime recovery.

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