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Deactivation of deep level impurities in hyperdoped silicon CHRISTIE SIMMONS, MARK WINKLER, JOSEPH SULLIVAN, Massachusetts Institute of Technology, DANIEL RECHT, MICHAEL AZIZ, Harvard School of Engineering and Applied Sciences, TONIO BUONASSISI, Massachusetts Institute of Technology — Extremely high concentrations of deep level impurities in silicon have exhibited unique properties of interest for optoelectronic and photovoltaic applications. For example, silicon hyperdoped with chalcogens demonstrates significant infrared absorption at wavelengths longer than the band edge of silicon. Hyperdoped silicon is fabricated by high-dose ion implantation followed by pulsed laser melting and rapid re-solidification. The result is a metastable supersaturated solid solution with doping concentrations orders of magnitude above the room temperature solubility limit. Thermal annealing results in a deactivation of the sub-gap absorption in this material, suggesting that the precise chemical state of the deep level impurities is a critical component of the enhanced absorption. To gain further insight to the absorption mechanism and the stability this material, we present a detailed investigation of the deactivation induced by rapid thermal annealing of silicon hyperdoped with sulfur.

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