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Spectral and Spatial Response of Sulfur-Hyperdoped n+/p Silicon Photodiodes[1] DAVID HUTCHINSON, Rensselaer Polytechnic Institute, DANIEL RECHT, Harvard University, JOSEPH SULLIVAN, Massachusetts Institute of Technology, JEFFREY WARRENDER, US Army - ARDEC, Benet Laboratories, MICHAEL AZIZ, Harvard University, TONIO BUONASSISI, Massachusetts Institute of Technology, PETER PERSANS, Rensselaer Polytechnic Institute —
Pulsed laser melting of implanted silicon can enable doping well above equilibrium concentrations. Sulfur doping leads to a deep donor state that may form an impurity band at high enough concentrations. Photodiodes formed from sulfur-hyperdoped n+ layers on a p-type wafer have shown external quantum efficiency of much greater than 100%, as well as enhanced infrared response. In this paper we report on optoelectronic characterization of diodes prepared by implantation of $10^{15} - 10^{16}$ sulfur/cm2 into a p-type wafer, followed by nanosecond pulsed laser melting and recrystallization. Experimental results from wavelength-dependent diode response, spatial quantum efficiency mapping, intensity dependent efficiency, and current-voltage techniques will be reported. We will also discuss potential models for the observed behavior.

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