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Hyperdoping silicon for intermediate band photoconductivity YINING LIU, University of Dayton, WENJIE YANG, Austrilian National University , QUENTIN HUDSPETH, JEFFREY WARRENDER, Benet lab, JAMES WILLIAMS, Austrilian National University, JAY MATHEWS, University of Dayton — Hyperdoped silicon is a promising material for infrared detection. Supersaturated solutions of impurities in Si are produced in order to create intermediate bands (IBs) in between the valence and conduction bands. This new IB serves on sub-band gap absorption. Ion implantation followed by pulsed laser melting has been demonstrated as a method to produce concentrations of impurities in Si that are well above the solid solubility limit. In this work, we look at Si hyperdoped with Au or Ti. To achieve devices that could be commercialized for FPAs or other demanding applications, efficient ones will require significant optical absorption and high quality Ohmic contacts for carrier extraction. We fabricated Si layers hyperdoped with Au or Ti at varying concentrations, measured the optical absorption enhancement relative to Si, and attempted to form Ohmic contacts to the layers. The results show significant enhancement of optical absorption by increasing the implant dose. For making Ohmic contacts to hyperdoped materials, we tried several treatments, including boron or phosphorus shallow doping, rapid thermal annealing of contact, etching off the top metallic layer, and modifying the PLM process to suppress dopant segregation. Recipes for Ohmic contacts to each layer were demonstrated.

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