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Extending silicon's infrared response through laser hyperdoping with gold JEFFREY WARRENDER, QUENTIN HUDSPETH, US Army ARDEC-Benet Laboratories, HARRY EFSTATHIADIS, SUNY-Polytechnic Institute, ELIF ERTEKIN, University of Illinois at Urbana-Champaign, JAY MATHEWS, University of Dayton — Pulsed laser melting of silicon ion-implanted with gold has recently been shown to form a highly crystalline layer with a significantly greater-than-equilibrium gold concentration.[1] Rudimentary devices made with such a laser-doped layer exhibit device response at room temperature under illumination by infrared photons with wavelengths out to 2200 nm.[2] The external quantum efficiency in the infrared is approximately 10^{-4}. In this presentation, we will describe efforts to increase the quantum efficiency and avert the high cost and time of ion implantation. We study the effect of varying the gold implantation dose on the resultant gold concentration in the layer and the optoelectronic properties of the layer. Additionally, we show that an alternative approach to incorporating the gold, through deposition of a thin gold layer onto the silicon surface prior to laser melting, achieves gold concentrations comparable to those achievable by ion implantation, approximately 2 x10^{19} atoms per cubic centimeter. We perform optoelectronic measurements on layers fabricated in this way and compare to the results obtained when using the preparation method detailed in [1] and [2]. [1] Recht *et al.*, *J. Appl. Phys.* **114**, 124903 (2013) [2]Mailoa *et al.*, *Nature Communications* **5**, 3011 (2014)

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