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$Ge_{0.98}Sn_{0.02}$/Si $p-i-n$ Heterostructure Photodiodes for Telecommunications Applications JAY MATHEWS, JOSE MENENDEZ, Department of Physics, Arizona State University, Tempe, AZ, 85287-1504, USA, SHUI-QING YU, Department of Electrical Engineering, University of Arkansas, Fayetteville, AR 72701, USA, RADEK ROUCKA, JUNQI XIE, JOHN KOUVETAKIS, Department of Chemistry and Biochemistry, Arizona State University, Tempe, AZ, 85287-1604, USA — In this study, $p-i-n$ heterostructure photodiodes were fabricated from $Ge_{0.98}Sn_{0.02}$ films grown directly on Si substrates using complementary metal-oxide-semiconductor (CMOS) compatible processes. The devices characterized with respect to their dark currents and their quantum efficiency in the near IR. The structures were grown on boron-doped (p-type) Si(100) with resistivity 0.01 Ωcm. A 350nm thick layer of intrinsic $Ge_{0.98}Sn_{0.02}$ was deposited first as the active region, followed by 64nm of phosphorus-doped (n-type) $Ge_{0.98}Sn_{0.02}$. The current-voltage characteristics of the devices yielded distinctly diode-like behavior. The measured photoresponse yielded higher quantum efficiencies than comparable pure-Ge devices over a broader spectrum as a result of the lower direct band gap and broadening of the absorption edge due to alloying. The significant responsivity obtained at wavelengths as long as 1750 nm confirms the advantages of the GeSn approach for telecom applications.

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