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GeSn *pin* diodes: from pure Ge to direct-gap materials[1] JAMES GALLAGHER[2], CHARUTHA SENARATNE[3], CHI XU[4], TOSHIHIRO AOKI[5], JOHN KOUVETAKIS[6], JOSE MENENDEZ[7], Arizona State Univ — Complete $n-i-p$ $Ge_{1-y}Sn_y$ diode structures (y=0-0.09) were fabricated on Si substrates with Sn concentrations covering the entire range between pure Ge and direct-gap materials. The structures typically consist of a thick (>1 μm) $n++$ Ge buffer layer grown by Gas Source Molecular Epitaxy using Ge_4H_{10} and either $P(SiH_3)_3$ or $P(GeH_3)_3$, followed by a GeSn intrinsic layer ($\sim$ 500 nm), grown by Chemical Vapor Deposition (CVD) using Ge_3H_8 and SnD_4, and a GeSn p-type top layer ($\sim$ 200 nm) grown by CVD using Ge_3H_8, SnD_4 and B_2H_6. Temperature-dependence of the $I-V$ characteristics of these diodes as well as the forward-bias dependence of their electroluminescence (EL) signal were investigated, making it possible for the first time to extract the compositional dependence of parameters such as band gaps, activation energies, and dark currents. The EL spectra are dominated by direct-gap emission, which shifts from 1590 nm to 2300 nm, in agreement with photoluminescence results.

[1]DOD AFOSR FA9550-12-1-0208 and DOD AFOSR FA9550-13-1-0022
[2]Department of Physics
[3]Department of Chemistry and Biochemistry
[4]Department of Physics
[5]LeRoy Eyring Center for Solid State Science
[6]Department of Chemistry and Biochemistry
[7]Department of Physics

James Gallagher
Arizona State Univ

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