Abstract Submitted
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Structural, Vibrational, and Electronic Properties of Ternary SiGeSn Alloys[1] VIJAY R. D'COSTA, JOSÉ MENÉNDEZ, ANDREW V.G. CHIZMESHYA, JOHN TOLLE, JOHN KOUVETAKIS, Arizona State University — The recent demonstration of ternary SiGeSn alloys represents a significant breakthrough that adds new levels of flexibility to the design of microelectronic and optoelectronic devices based on group-IV materials. We present a systematic experimental and theoretical study of the structural, vibrational, and electronic properties of this material. X-ray reciprocal lattice maps are used to determine the equilibrium lattice constant of the alloys, whose composition is measured independently by Rutherford Backscattering. It is found that the system follows Vegard's law quite closely, in contrast to GeSn alloys, which show evidence for bowing in the compositional dependence of the lattice constant. The Raman spectrum shows the three standard Si-Si, Ge-Si, and Ge-Ge peaks found in GeSi alloys. No evidence for Sn-Ge or Sn-Si modes is seen, but the three observed peaks shift in frequency as a function of the Sn concentration. The energy of the direct optical transitions display significant bowing as a function of the alloy composition. The dominant source of bowing appears to be the simultaneous presence of Si and Sn atoms in the ternary alloy.

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Jose Men
Arizona State University

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