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Structural and Optical Properties of Sn_xGe_{1-x} thin films and Quantum Dots JORDANA BLACKSBERG, L. DOUGLAS BELL, SHOULEH NIKZAD, Jet Propulsion Labs — Sn_xGe_{1-x} layers and quantum dots (QDs) are of great interest as materials that could provide tunable direct band gaps, allowing completely group IV-based optoelectronic devices. These materials could be used in a wide range of applications such as emitters, infrared detectors, and thermophotovoltaics. However, substantial challenges remain in the growth and processing of these materials. We have grown Sn_xGe_{1-x} films by Molecular Beam Epitaxy (MBE), using low growth temperatures (<200°C) in order to grow fully strained layers. X-ray diffraction, transmission electron microscopy, and Rutherford backscattering spectroscopy data indicate high-quality epitaxial films. Post-growth annealing was used to form QDs. Either QDs or quantum wires may be formed depending on annealing parameters. The effects of varying substrate temperature between 400C (wires) and 750C (QDs) on size and distribution of quantum structures were explored and will be discussed. Sn concentration (0-10%) and film thickness (40nm - 200nm) were also varied. Optical properties probed by Fourier transform infrared spectroscopy (FTIR) will be presented. FTIR spectra clearly show the decrease in band gap of Sn_xGe_{1-x} layers with increasing Sn fraction up to 10%. Photomodulated reflectance (PR) is another sensitive method for probing critical points in Sn_xGe_{1-x} band structure, and can detect both direct and indirect transitions. PR results for Sn_xGe_{1-x} layers will also be discussed.

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