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Observation and Analysis of Optical Gain in GeSn Waveguides at room temperature ZAIRUI LI, YUN ZHAO, Electro-Optics Program, University of Dayton, JAMES GALLAGHER, Department of Physics, Arizona State University, JOHN KOUVETAKIS, Department of Chemistry and Biochemistry, Arizona State University, IMAD AGHA, JAY MATHEWS, Electro-Optics Program and Department of Physics , University of Dayton, JOSE MENENDEZ, Department of Physics, Arizona State University — CMOS-compatible optoelectronic devices are an important area of research for the semiconductor industry. The development of Si-based lasers has potentials for optical interconnects and photonic integrated circuits, is still a major challenge. The recent demonstration of lasing in GeSn waveguides at low temperature shows that these materials could be a pathway. In this work, we present an observation of significant nonlinear optical emission from GeSn -on-Si waveguides operating at room temperature. We also present a physical model for the emission in order to understand the effects of carrier generation and recombination in GeSn alloys. Experimentally, waveguides were fabricated from GeSn films grown epitaxially on Si(100) substrates. After mirror polishes the facets, a 976nm wavelength solid-state laser optical-pump was applied onto the waveguide at room temperature and the corresponding emission power was observed. The results show strong nonlinear dependence on pump power, indicating optical gain. Since the emission is incoherent, we modeled the results as amplified spontaneous emission. Shockley-Read-Hall and Auger recombination was considered, and we calculate the spontaneous emission spectrum, the optical gain in the material, and the total power emitted from the waveguide.

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