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Suppression of free carrier absorption in silicon using multislot SiO_2/nc-Si waveguide HALINA KRZYZANOWSKA, Department of Physics and Astronomy, Vanderbilt University, Nashville, TN 37235, YIJING FU, The Institute of Optics, University of Rochester, Rochester, NY 14627, USA, KARL NI, Department of Electrical and Computer Engineering, University of Rochester, Rochester, NY 14627, USA, PHILIPPE FAUCHET, Department of Electrical Engineering and Computer Science, Vanderbilt University, Nashville, TN 37235, USA — Nanocrystalline silicon has been proposed as a promising candidate for future silicon CMOS-compatible light emitting device. To achieve Si-based light sources at the standard telecommunication wavelength (1535 nm) Si nanostructures can be doped with rare earth elements. However, free carrier absorption (FCA) has been recognized as a major obstacle towards achieving net optical gain from a material containing Si nanostructures. Thus it is critical to develop approaches that suppress FCA to achieve optical gain in this material system. In this talk, experimental results of pump-induced loss for TE and TM polarization in multislot Er doped SiO_2/nc-Si waveguides will be presented. Continuous wavelength and ultrafast studies of carriers excited in the nc-Si multilayers reveal strong suppression of transmission loss related to free carrier absorption in Si nanostructures for TM polarized probe light. We demonstrate theoretically and experimentally that free carrier absorption may be reduced under TM polarization as much as 9 times compared to TE polarization. This approach may remove a major obstacle for future Si-based light emission devices, as free carrier absorption may no longer dominate over the optical gain.

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