Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Nonlinear photonic crystals of $BaTiO_3$ and their electro-optic properties BRUCE WESSELS[1], Department of Materials Science and Engineering and Materials Research Center, and Department of Electrical Engineering and Computer Science, JIANHENG LI, ZHIFU LIU, Department of Materials Science and Engineering and Materials Research Center, Northwestern University, Evanston, IL 60208, USA, ELECTRONIC AND PHOTONIC MATERIALS GROUP TEAM
— Future optical systems will require electro-optic (EO) modulators with bandwidths of 100 GHz and low drive voltage. To achieve this, non-linear photonic crystals using epitaxial $BaTiO_3$ have been proposed. In our work two-dimensional photonic crystal (PhC) structures with a hexagonal array were fabricated from an epitaxial $BaTiO_3$ thin film using focused ion beam milling. The PhC waveguides were based on Si_3N_4/BTO/MgO multilayer epitaxial thin film structure. Simulation shows that sufficient refractive index contrast is achieved at 1550 nm to form a bandgap in the PhC structure by milling through the Si_3N_4 and BTO layers. The measured transmission spectrum of the PhC waveguide exhibited a stop-band centered at 1550 nm with well-defined band edges. Photonic crystal electro-optic modulators with a bandwidth of greater than 50 GHz have now been realized. The question of what dielectric properties limit the ultimate bandwidth of the PhC will be addressed.

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Date submitted: 20 Nov 2011 Electronic form version 1.4