Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Interfacial Stresses and Strains Effect on Band-Gap Emission from Silicon SUFIAN ABEDRABBO, The Petroleum Institute and The University of Jordan, ANTHONY FIORY, New Jersey Institute of Technology — Czochralski silicon wafer materials were interfaced with silica films formed by sol-gel deposition and thermal annealing. Under optimal annealing conditions (∼700 °C), stresses in the silica films induce variations in elastic strains on the order of 1% in the silicon. Concomitantly, emission of band-gap photons at 1.1 eV observed by photoluminescence is increased by two orders of magnitude relative to unperturbed silicon. The enhancement in photon emission is produced by band-gap modulations estimated as ∼0.1 eV. Elastic reversibility of the strains is inferred from recovery of relatively weak photon emission for annealing above the glass reflow temperature of deposited silica films (∼950 °C). Films with largest stress variations exhibit enhanced absorption signatures in the infrared and broadening of Si-O-Si stretching vibrations. Examples of Si-based photonics based on the observed effect will be presented.

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Date submitted: 05 Nov 2015 Electronic form version 1.4