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Modeling Conformal Growth in Photonic Crystals and Comparing to Experiment ANDREW BRZEZINSKI, YING-CHIEH CHEN, PIERRE WILTZIUS, PAUL BRAUN, Dept. of Mat. Sci. & Eng. / Beckman Institute / U. of Illinois, Urbana — Conformal growth, e.g. atomic layer deposition (ALD), of materials such as silicon and TiO_2 on three dimensional (3D) templates is important for making photonic crystals. However, reliable calculations of optical properties as a function of the conformal growth, such as the optical band structure, are hampered by difficultly in accurately assessing a deposited material's spatial distribution. A widely used approximation ignores "pinch off" of precursor gas and assumes complete template infilling. Another approximation results in non-uniform growth velocity by employing iso-intensity surfaces of the 3D interference pattern used to create the template. We have developed an accurate model of conformal growth in arbitrary 3D periodic structures, allowing for arbitrary surface orientation. Results are compared with the above approximations and with experimentally fabricated photonic crystals. We use an SU8 polymer template created by 4-beam interference lithography, onto which various amounts of TiO_2 are grown by ALD. Characterization is performed by analysis of cross-sectional scanning electron micrographs and by solid angle resolved optical spectroscopy.

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