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3D Photonic Crystals from a Forest of ZnO Nano-Pillars DONALD PRIOUR, Youngstown State University (YSU) — The band gap and dispersion curves are obtained for photonic crystals made up of square or hexagonal arrays of ZnO nano-pillars with a periodic modulation of the refractive index along the axis of the pillars. The wavelength of the intra-pillar index of refraction variation and the unit cell of the pillar lattice are in the optical range, on the order of 500 nm. The photonic dispersion curves are calculated with a treatment analogous to the nearly free electron model used in electronic band structure calculations; we expand in terms of wave functions compatible with the symmetry of the Brillouin Zone and thereby avoid discretizing the nano-pillar geometries. We validate our results by comparison with band structures obtained by alternative techniques for special lattice geometries. To examine the effect on salient features of the band structure, and to maximize the band gap, we vary parameters such as the pillar radius, the pillar lattice unit cell size, and the wavelength and amplitude of the intrapillar refraction index modulations. While on the one hand we consider an idealized forest comprised of infinitely tall pillars, we also examine finite pillars, the situation to be studied in experiment.

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