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The effect of capillary condensation on optical transmission in porous silicon VLADIMIR AJAEV, Southern Methodist University — Capillary condensation in porous silicon superlattices can be used to design photonic structures with unique and easily tunable properties, as recently demonstrated by Barthelemy et al. [Nature Photonics, 1, 172 (2007)]. Potential applications of these structures range from switching devices in communications networks to optical computing. The effect of condensed liquid on the optical properties of porous silicon is usually described in terms of the volume fraction of the liquid. The latter is found from either adsorption studies in disordered porous media or approximate models of capillary condensation in macroscopic pores of circular cross-section. However, porous silicon used in optical applications is in fact an ordered structure with long non-intersecting pores of polygonal cross-section and typical cross-sectional dimensions on the order of 100 nm. We develop a model of capillary condensation in such structures and use it to interpret recent experimental studies of transmission of optical signals through porous silicon partially filled with liquid.

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