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Photonic band structures of periodic arrays of pores in a metallic host: tight-binding beyond the quasistatic approximation[1] KWANGMOO KIM, Research Institute of Advanced Materials, Seoul National University, Seoul, 151-742, Republic of Korea, DAVID STROUD, Department of Physics, The Ohio State University, Columbus, Ohio 43210, USA — We have calculated the photonic band structures of metallic inverse opals and of periodic linear chains of spherical pores in a metallic host, below a plasma frequency $\omega_{\rm p}$. In both cases, we use a tight-binding approximation, assuming a Drude dielectric function for the metallic component, but without making the quasistatic approximation. The tight-binding modes are linear combinations of the single-cavity transverse magnetic (TM) modes. For the inverse-opal structures, the lowest modes are analogous to those constructed from the three degenerate atomic p-states in fcc crystals. For the linear chains, in the limit of small spheres compared to a wavelength, the results bear some qualitative resemblance to the dispersion relation for metal spheres in an insulating host, as calculated by Brongersma *et al.* [Phys. Rev. B **62**, R16356 (2000)]. Because the electromagnetic fields of these modes decay exponentially in the metal, there are no radiative losses, in contrast to the case of arrays of metallic spheres in air. We suggest that this tight-binding approach to photonic band structures of such metallic inverse materials may be a useful approach for studying photonic crystals containing metallic components.

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