

Actively Tunable Photonic Crystal Functional Elements Based on Optically Anisotropic Materials

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We present device designs in 2D macroporous silicon photonic crystals based on the infiltration of individual pores with liquid crystals which yield actively tunable photonic functional elements. These designs have been developed via a photonic Wannier function approach [1] that allows the characterization of such functional elements by frequency-dependent guided-mode scattering matrices that relate guided incoming to outgoing modes in the waveguides connected to the device. In turn, these scattering matrices form the basis of a quantitative circuit theory that allows to design complex devices, such as Mach-Zehnder interferometers, that are very hard to handle with other simulation techniques.

[1] K. Busch et al., *J. Phys. Cond. Mat.* **15**, R1233 (2003).