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Microplasma Photonic Crystals Beyond Three-Dimensions

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An isotropic dielectric photonic crystal has been designed and demonstrated at the University of Illinois. The entire multidimensional structure is fabricated in a flexible polymer and the lattice constant is currently 500 μm. Interspersing 355 μm diameter microchannels along three spatial coordinates allows the plasma filling factor to increase to ˜ 10%. The ignition of plasma within polymer/dielectric microcolumn arrays results in narrowband resonances that are tunable by as much as 1.2 GHz at 164 GHz. Introducing plasma has the effect of blue-shifting attenuation peaks of the resonator and increasing the time-averaged attenuation by 13.7 dB. Electromagnetic induced transparency is also observed in custom-designed waveguide configurations. These crystals offer a higher level of symmetry and Fabry-Pérot resonator modes are observed. These crystals provide functionality not available with conventional photonic crystals that are not reconfigurable at electronic speeds.

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