THz metal mesh filters on thick fused silica substrate*

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Metamaterial-based THz devices, including amplitude/phase and spatial modulators, sensors and filters, play a crucial role for the controlling and manipulating of THz waves [1]. In this paper, we design and fabricate a series of cross-shaped THz bandpass filters ranging from 0.1 to 0.5 THz on commercially available 525 μm thick fused silica substrate. Since at THz frequencies, the thickness of the substrate is comparable to the free-space wavelength, conventional cross-shaped filters suffer from substrate resonances and Fabry–Pérot resonances. To further suppress unwanted frequency components, a complementary cross-shaped structure is added to the original design to form trapped mode excitations [2]. The enclosed crosses and the outer structure have opposite surface current distribution due to their complementary shapes. This results in a high transmission at and near the resonant frequency. Simulation results suggest > 80% transmittance with good out-of-band rejection for all designs. The measurements are undertaken using a Rohde and Schwarz ZVA from 75-500 GHz using a collimated beam in quasi optical setup.

References

[1] S. Lucyszyn, F. Hu and W. J. Otter, "Technology Demonstrators for Low-cost Terahertz Engineering", *2013 Asia-Pacific Microwave Conference (APMC2013)*, Seoul, South Korea, Nov. 2013 (Invited)

[2] O. Paul, R. Beigang, and M. Rahm, "Highly selective terahertz bandpass filters based on trapped mode excitation", *Opt. Express*, vol. 17, no. 21, pp. 18590-18595, Oct. 2009

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