Three-dimensional photonic crystals and metamaterials made by direct laser writing

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In this work we design and fabricate three-dimensional (3D) metallic photonic crystals and metamaterials operating in the THz region (see Fig. 1) and targeting asymmetric wave transmission and circular polarization filtering. The design and theoretical analysis of the structures is done using commercial software based on the finite element method. The fabrication is done by Direct femtosecond Laser Writing (DLW) of an organic-inorganic polymer with metal-binding moieties and selective silver coating using electroless plating. [1]. The DLW by multi-photon polymerization which is used here is a nonlinear optical technique which allows the fabrication of 3D structures with a resolution beyond the diffraction limit. The resolution of our structures is of the order of 100nm.

Theoretical analysis and preliminary electromagnetic characterization of some of our fabricated structures shows significantly large asymmetric transmission (diode-like response), which can have great impact in polarization isolation applications.

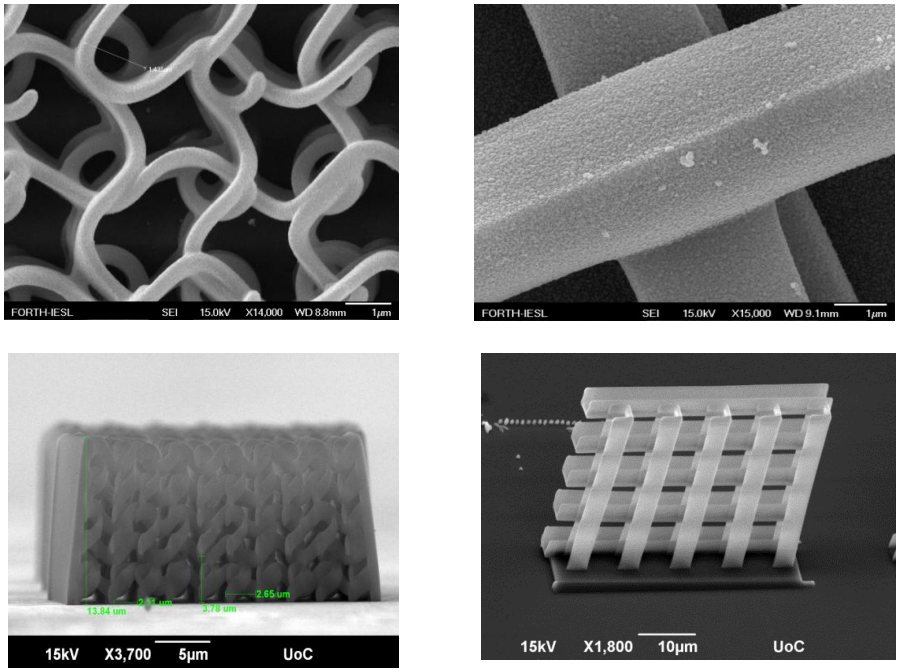

Figure 1: SEM pictures of the structures with the silver parts at the surface of the polymer material.

References

[1] Three-dimensional metallic photonic crystals with optical bandgaps, N. Vasilantonakis et al., Advanced Materials 24 (8), 1101-1105

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