Editorial

This feature issue on Metamaterials in Microwave and Optical Spectral Range has largely arisen from the guest editors' involvement with the European Union Network of Excellence '***Metamorphose***'. The network provides a common platform for many institutes across Europe in metamaterial research. Accordingly, this open special issue, focuses on interactions of electromagnetic waves with sub-wavelength scale structured artificial materials – ***Metamaterials***. Papers were submitted from France, Korea, Poland, Russia, Turkey, UK, Ukraine and USA.

The issue contains three invited papers. The first reviews applications of metamaterials as a means to manipulate the size, efficiency, bandwidth, and directivity of basic radiating and scattering systems. In the second invited paper, dielectric spheres embedded in a host dielectric material are used to build isotropic Double Negative (DNG) media. This is important as there have been only few known attempts to build isotropic DNG media. The third reviews several of the more common geometries used to build metamaterials with particular reference the resulting wavelength to lattice constant ratio as the structures are simplified.

The topic ***Metallic and dielectric 1D, 2D and 3D sub-wavelength structures for microwave and optical applications*** resulted in three submissions. In the experimental study of the magnetic resonance of split ring resonators (SRRs) in the microwave frequency regime the transmission of both single SRR unit cell and periodic arrays of SRRs was measured. SRRs exhibit both magnetic and electric resonance band gaps. Secondly, a theoretical investigation on the effect of surface silicon oxide layer on the photonic band structure of a macroporous silicon photonic crystal provides interest on a different scale. The Authors expect the observed band gap shift to result in applications in the fabrication of splitters or selectors of electromagnetic modes. Lastly, the results of fabrication of eutectic microstructures of terbium-scandium-aluminium garnet and terbium-scandium perovskite using the micro-pulling down method are presented. Both materials could have important applications in the field of photonic crystals and metamaterials.

Optical properties of effective media are discussed in two papers. The first presents experiments on the near-field imaging by a layered metamaterial composed of SRRs. A monopole source radiating at the resonance frequency of SRRs is imaged on the other side of the slab. The second paper is a theoretical study of a nonlinear response of the planar nanostructures made of ultra thin silver layers and the layers of Kerr-like nonlinear dielectric. This opens the possibility that the nanostructure transmission properties may be controlled from transparent to opaque and back at extremely low intensities of the light.

The promis topic of ***Device applications of metamaterials*** presents numerical simulations and the fabrication of a flat lens made of a photonic crystal. The photonic crystal slab has a form of an array of holes etched in an InP/InGaAsP/InP semiconductor layer. It operates in infrared at a wavelength of 1.5 μm.

In ***Plasmonics***, which is once again proving a rich source of research, the first paper theoretically examines light propagation along a dispersive plasmonic structure in the form of a circular dielectric waveguide with metal cladding. The effect of the diameter of a waveguide core on the dispersion characteristics might have important practical meaning for resolution and sensitivity of SNOM systems. A further paper in Plasmonics deals with energy transport in plasmon waveguides in the form of chains of silver nanorods and nanoplates.

Completing this special issue is a paper on ***Modelling metamaterials*** concerning a simple analytical model of a 3D periodic array of small magnetized or polarized ferrite ellipsoids. The analysis not only covers magnetic, but also electric and coupled electric and magnetic dipoles.

The guest editors express their sincere thanks to all authors contributing to this, we believe, truly stimulating feature issue.

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