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Propagation of Electromagnetic Waves in 3D Opal-based Magnetophotonic Crystals MARTHA PARDAVI-HORVATH, The George Washington University, GALINA S. MAKEEVA, OLEG A. GOLOVANOV, Penza State University, ANATOLII B. RINKEVICH, Institute of Metal Physics Ural Branch of Russian Academy of Science — Opals, a class of self-organized 3D nanostructures, are typical representatives of photonic bandgap structures. The voids inside of the opal structure of close packed SiO_2 spheres can be infiltrated by a magnetic material, creating magnetically tunable magnetophotonic crystals with interesting and potentially useful properties at GHz and THz frequencies. The propagation of electromagnetic waves at microwave frequencies was investigated numerically in SiO_2 opal based magnetic nanostructures, using rigorous mathematical models to solve Maxwell's equations complemented by the Landau-Lifshitz equation with electrodynamic boundary conditions. The numerical approach is based on Galerkin's projection method using the decomposition algorithm on autonomous blocks with Floquet channels. The opal structure consists of SiO_2 nanospheres, with inter-sphere voids infiltrated with nanoparticles of Ni-Zn ferrites. Both the opal matrix and the ferrite are assumed to be lossy. A model, taking into account the real structure of the ferrite particles in the opal's voids was developed to simulate the measured FMR lineshape of the ferrite infiltrated opal. The numerical technique shows an excellent agreement when applied to model recent experimental data on similar ferrite opals.

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