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Isotropic optical negative index of refraction metamaterials composed of randomly arranged nanoparticles ADIL-GERAI KUSSOW, Umass, Lowell, Dept. of Physics, ALKIM AKYURTLU, Umass, Lowell, Electical Eng, — We report a strategy for achieving fully isotropic negative refraction index in a homogenized composite medium (HCM) conceptualized using both Maxwell-Garnett's and Lewin's effective medium formulations. The HCM consists of two isotropic dielectric-magnetic media (DMM): one DMM (randomly distributed small gold nanoparticles in free space) provides only negative permittivity, and another DMM (spherical SiC particles) provides only negative permeability via the Mie resonance. We prove, in the framework of the effective medium approach, that the mixture of DMMs (with properly adjusted fill factors and sizes of Au and SiC particles) exhibits isotropic negative refraction index metamaterial (NIM) behavior with negative refraction index of in a broad frequency range of the optical part of the spectrum. This result stands for both random distribution of the spherical constituent SiC particles (or Maxwell-Garnett arrangement), and the regular simple-cubic lattice of the same particles (Lewin's arrangement). Due to the high 3D isotropy of both models, both the analytical and numerical solutions of the scattering problems were found to be close to each other, and NIM behavior has been demonstrated. The calculations were carried out accurately taking into account the losses due to both gold and SiC nanoparticles.

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