

# New Composite Gyrotropic Metamaterial

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In recent years, one can observe the rapid growth of research activities devoted to the materials, which exhibit the negative value of refractive index. These materials are commonly called *metamaterials*. In this work we propose a relatively simple way to produce metamaterial using the mixture of three ingredients, where one of them (single-domain ferromagnetic nanoparticles) is responsible for the negativity of real part of mixture's permeability  $\text{Re}[\mu(\omega)]$  and the other two (silver and  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  or  $\text{Pb}_{1-x}\text{Sn}_x\text{Te}$ ) are responsible for the negative value of real part of mixture's effective permittivity  $\text{Re}[\varepsilon(\omega)]$ . We have shown by computer simulations that by the proper fitting of model parameters (e.g. the radius of nanoparticles, their magnetic moments, the relative concentration of ingredients) it is possible to obtain the metamaterial with negative refraction index in a relatively broad range of temperatures and external magnetic fields, both for the  $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$  [1] and  $\text{Pb}_{1-x}\text{Sn}_x\text{Te}$  compounds.

[1] I. Tralle, P. Zięba, and W. Paško, *J. Appl. Phys.* **115**, 233509 (2014).