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Hybrid chiral metamaterials by dynamic shadowing growth JOHN GIBBS, Northern Arizona University, PEER FISCHER, ANDREW MARK, SAHAND ESLAMI, TUNG-CHUN LEE, Max Planck Institute for Intelligent Systems — Coupling optical and magnetic properties is possible in metamaterials and in higher-order magnetic field induced optical activities. Here, we show that these two mechanisms can be combined in nanostructures that are simultaneously ferromagnetic, chiral, and plasmonically resonant. In this talk, a short description of the fabrication of optically active helical metamaterials will first be given, followed by the highlighting of the materials' enhanced optical properties. Giant circular dichroism (CD) and optical rotatory dispersion (ORD) in the visible arise from helical plasmonic modes within the individual structures and can be tuned by altering the material composition, i.e. nanoalloys or nanocomposites, and/or by changing the structures' morphologies. By fabricating metamaterials which exhibit both strong CD and are ferromagnetic at room temperature, higher order terms in the generalized dielectric function in the presence of a B-field can be measured easily. In particular, magnetochiral dichroism (MChD) is a cross-term between chirality and an applied external B-field which has only been measured in crystals and molecules, but never in a metamaterial. We show that arrays of helical Ni nanostructures, due to the plasmonic nature of Ni, their chirality, as well as the fact they retain their ferromagnetism even at scales comparable to the average ferromagnetic domain size, exhibit an MChD signal that is much more pronounced in a metamaterial and can therefore be easily measured in the laboratory.

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