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Cross-Polarized Wave Generation in a Nonlinear Hyperbolic Metamaterial

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A generation of cross-polarized wave (XPW) in nonlinear hyperbolic metamaterials (NHMM), which are composed of periodic arrangement of gold (Au) and barium difluoride (BaF2) layers with subwavelength thickness for exhibiting anisotropy of permittivity and third-order nonlinearity, has been investigated numerically. This cubic nonlinear effect is described by degenerate four-wave mixing (DFWM) of three linearly polarized fields and one produced field, which has linear polarization in orthogonal direction. By managing the fill-factor value of the NHMM, the nearly phase-matched condition based on quasi-birefringent phase-matching (QBPM) technique are achieved implicitly. We found that the conversion efficiencies of XPW generation as a function of incident angle at various pumping intensities are maximized at optimal incident angle.

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