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Title:Ultrafast optical modulation of terahertz metamaterials

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Abstract:We have characterized the ultrafast dynamical properties of split ring resonators by utilizing optical pump-terahertz probe spectroscopy on a subpicosecond timescale. The experimental results show that the pump-induced relative changes in terahertz peak transmission, as well as the dynamical transmission spectra, are different when the terahertz electric vector is perpendicular and parallel to the gap of the split ring resonator. It is found that the pump-induced photogenerated carriers play two opposite roles in SRRs, showing one is to absorb terahertz to reduce the transmission in the substrate and the other is to weaken the resonant absorption to enhance the transmission. Our numerical simulations also prove that the pump pulse significantly influences the split ring resonator currents. We also show that the blue-shifts of the resonances are due to the change of optical constants in the photoexcited semiconductor substrate.

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