Thermally tunable magnetic metamaterials at THz frequencies

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Looking for alterable metamaterials, whose electromagnetic properties can be dynamically and real-time controlled, has attracted a great attention recently. In this report, we firstly investigated theoretically and numerically the tunability of the magnetic property of metamaterial in the THz region via thermal control. Then the thermo-tunable polarization-insensitive of the left-handed metamaterials was studied. The conventionally used metal is replaced by InSb in which the temperature-dependent conductivity plays a key role in tuning the magnetic and also the left-handed frequencies. It was found that when the temperature of the InSb stack increases from 300 to 350 K, the resonance peak of the transmission spectra shows a shift from 0.6 to 0.85 THz accompanied by a stronger magnetic behavior. While the left-handed transmission peak shifts from 0.8 to 1.1 THz and fractional bandwidth of the negative refractive index goes from 14% to 22%. Thermally increased carrier density of InSb is found to be the reason for the enhanced magnetic resonance and stronger left-handed behavior in addition to the tunability. The equivalent LC circuit model and standard retrieval method are performed to elaborate our proposed idea.

References

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