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# Tuning the plasmonic regime in high temperature superconductor metamaterials

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Superconductors are promising candidates for active and tunable metamaterials in the terahertz (THz) range. In this work, we demonstrate the modulation, through temperature, of the intensity, linewidth and frequency of plasmonic features of high temperature superconductors (cuprates and MgB2) based metamaterials. Through a detailed analysis of the parameters characterizing these plasmonic excitations, we also extract some important properties of superconductor compounds, like the penetration depth and the superfluid density. These parameters are usually measured in microwaves using guide propagation and cavity techniques. These techniques, for physical limitations, are hard to extend in the THz range. Using free-space propagation and virtual resonant cavity induced on samples by litographed sub-wavelength resonators, we obtain the temperature dependence of the superfluid density and penetration depth for frequencies up to 3 THz.

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