Abstract Submitted
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Symmetry-broken metamaterial absorbers as reflectionless directional couplers for surface plasmon polaritons in the visible range[1] FAN YE, MICHAEL J. BURNS, MICHAEL J. NAUGHTON, Boston College, Department of Physics, Chestnut Hill, MA, 02467 — Recently, gradient-index meta-surfaces have been shown to have the ability to manipulate wavefronts at will in a reflectionless manner in the GHz range, including the extreme example of converting freely propagating waves into surface waves with high-efficiency. Upon approaching the visible regime, the gradient-index concept encounters difficulties due to fabrication limitations. Here, we demonstrate theoretically and experimentally that asymmetric, periodic, two-element metal-insulator-metal structures can serve as reflectionless directional convertors between freely propagating visible photons and surface plasmon polaritons (SPP). Coupling between propagating modes caused by the broken symmetry and localized modes generated by individual elements is shown to be the main mechanism of this high-efficiency process. Direct experimental evidence is obtained for reflectionless ($< 8\%$ measured reflectance) directional SPP coupling in the visible range, with a directionality of 99.7%. A novel measurement scheme is developed for the characterization of absolute reflectance of samples with micron-sized area under normal incidence in the visible range. Our results are meaningful for integrated nanoplasmonics, plasmonic logic, and plasmonic light harvesting, among others.

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