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Title:Design and Analysis of a THz Metamaterial Structure with High Refractive Index at Two Frequencies
Authors:Zan Lu (1); Camps-Raga, B. (2); Islam, N.E. (1)
Author affiliation:(1) Electr. & Comput. Eng. Dept., Univ. of Missouri, Columbia, MO, United States; (2) MR: comp GmBH, Gelsenkirchen, Germany
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Abstract:The concept of a single frequency band, single high-refractive-index metamaterial has been extended and applied in the design of dual frequency band, dual high-refractive-index metamaterials in the THz regime. The structure design consists of twenty five unit cells with a surface area of 250 um by 250 um and a thickness of 5 um. Each cell has metallic structures embedded in a polyimide substrate. The return loss (S-parameter) analysis shows two strong electric responses at two frequency ranges, and the extracted constitutive parameters suggested high values of simultaneous dielectric constant and permeability at these frequencies. Results retrieved from the S-parameters also show high refractive index values. A first peak refractive index of 61.83 was observed at a resonant frequency of 0.384 THz, and another peak refractive index of 19.2 was observed at the resonant frequency 1.416 THz. Analysis show that higher refractive index at the second resonance frequency band is achievable through redesign of the structures, and modifications could lead to a single structure with multiple frequency, multiple high-refractive-index metamaterials that can be put to practical use.
Number of references:27
Inspec controlled terms:metamaterials - permeability - permittivity - refractive index - S-parameters - terahertz materials - terahertz wave spectra
Uncontrolled terms:THz metamaterial structure - single frequency band - single high-refractive-index metamaterial - dual frequency band - dual high-refractive-index metamaterials - metallic structures - polyimide substrate - S-parameter - dielectric constant - permeability - frequency 0.384 THz - frequency 1.416 THz - size 5 mum
Inspec classification codes:A4270 Optical materials - A7720 Dielectric permittivity - A7820D Optical constants and parameters (condensed matter) - A7870G Microwave and radiofrequency interactions with condensed matter - B4110 Optical materials - B1305 Microwave materials - B2810 Dielectric materials and properties
Numerical data indexing:frequency 3.84E+11 Hz;frequency 1.416E+12 Hz;size 5.0E-06 m
Treatment:Theoretical or Mathematical (THR)
Discipline:Physics (A); Electrical/Electronic engineering (B)

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