280
Accession number:20125115815415
Title:Terahertz plasmon and surface-plasmon modes in hollow nanospheres
Authors:Xiao, Yiming (1); Xu, Wen (1); Zhang, Yaya (1); Hu, Jiaguang (1)
Author affiliation:(1) Department of Physics, Yunnan University, Kunming, 650091, China; (2) Key Laboratory of Materials Physics, Institute of Solid State Physics, Chinese Academy of Sciences, Hefei, 230031, China; (3) Department of Math and Physics, Wenshan University, Wenshan, 663000, China
Corresponding author:Xu, W.(wenxu_issp@yahoo.cn)
Source title:Nanoscale Research Letters
Abbreviated source title:Nanoscale Res. Lett.
Volume:7
Issue date:2012
Publication year:2012
Pages:1-6
Language:English
ISSN:19317573
E-ISSN:1556276X
Document type:Journal article (JA)
Publisher:Springer New York, 233 Spring Street, New York, NY 10013-1578, United States
Abstract:We present a theoretical study of the electronic subband structure and collective electronic excitation associated with plasmon and surface plasmon modes in metal-based hollow nanosphere. The dependence of the electronic subband energy on the sample parameters of the hollow nanosphere is examined. We find that the subband states with different quantum numbers l degenerate roughly when the outer radius of the sphere is r<inf>2</inf> ≥ 100 nm. In this case, the energy spectrum of a sphere is mainly determined by quantum number n. Moreover, the plasmon and surface plasmon excitations can be achieved mainly via inter-subband transitions from occupied subbands to unoccupied subbands. We examine the dependence of the plasmon and surface-plasmon frequencies on the shell thickness d and the outer radius r<inf>2</inf> of the sphere using the standard random-phase approximation. We find that when a four-state model is employed for calculations, four branches of the plasmon and surface plasmon oscillations with terahertz frequencies can be observed, respectively. © 2012 Xiao et al.
Number of references:23
Main heading:Plasmons
Controlled terms:Nanospheres - Quantum theory - Spheres - Terahertz waves
Uncontrolled terms:Collective excitation mode - Electronic excitation - Electronic subband energies - Energy spectra - Hollow nanospheres - Intersubband transitions - Quantum numbers - Random phase approximations - Shell thickness - Subband structures - Subbands - Surface plasmon excitation - Surface plasmon modes - Surface plasmon oscillation - Surface-plasmon - Tera Hertz - Terahertz frequencies - Terahertz radiation - Theoretical study
Classification code:631 Fluid Flow - 711 Electromagnetic Waves - 761 Nanotechnology - 931.3 Atomic and Molecular Physics - 931.4 Quantum Theory; Quantum Mechanics - 933 Solid State Physics
DOI:10.1186/1556-276X-7-578