Iranian Journal of Physics Research, Vol. 19, No. 4, 2020

Investigating the diameter effect of gold and silver nanoshells with specific outsider diagonal on localized surface pasmon resonance by the FDTD method

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(Received 12 March 2019 ; in final form 23 July 2019)

Abstract

In this research, localized surface plasmon resonance spectra for single spherical gold nanoparticles with a radius between 20 to 55 nm in the environments of different refractive indices between 1 and 1.8 has been studied by Finite Different Time Domain method. In these simulations, plasmon resonance frequency is determined for each nanoparticle with optimized mesh size, and it is compared with the results of Mie theory. Moreover, by using these results, the plasmonic properties of gold (silver) nanoshells of various diameters are studied in air (n=1) and water (n=1.33). Plasmon resonance has been calculated for nanoshells, showing that in different environments, gold (silver) nanoshells with the outer radius of 20 nm and diameter of 12 (17) nm have their plasmonic spectrum associated on gold (silver) nanosphere with the same outer radius. Frequency for nanoshells has been calculated. The plasmon resonance peak shift for various nanoparticles is plotted versus refractive indices. Finally, the most sensitive and insensitive nanoparticles to the refractive index of the environment are discussed for sensing applications.

Keywords: surface plasmons, gold nanoparticles, nanosensors, finite different time domain method

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