Electromagnetic Simulation on Silver Nanoparticle Based Biosensors

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Abstract

In this paper, we have theoretically investigated the biosensing capability and silver nanoparticle. We study the optical properties of the electromagnetic simulation of silver nanoparticle in far field and near fields. Silver nanoparticles have unique optical and electronic properties which make them suitable for biosensing applications. The interaction of light with silver nanoparticle produces a collective oscillation of conduction band electron known as localized surface plasmon resonance. Plasmon resonance occurs when the frequency (wavelength) of the source is equal to the target frequency. Around this peak wavelength, we can detect the presence of desired target. To simulate the extinction cross section of silver nanoparticle in the Plasmonic resonance peaks in far and near fields, Finite Difference Time Domain (FDTD) method is applied. In our investigations the optical properties of plasmon resonance peak position occur in the visible and near infrared light (400 nm to 800 nm). Using FDTD method, the Plasmonic resonance enhanced light extinctions has been determined for nanodisk shaped silver nanoparticles with radius range from 10 nm to 60 nm. The electromagnetic sources are used based on the frequency- domain field and power design, including completely customizable uniaxial- perfectly matched layer (UPML) to simulates the real open system.

Key word: silver nanoparticle, Biosensors, localized surface plasmon, Plasmon resonance, FDTD

1. Introduction

The term biosensor is an abbreviation to mean biological sensor. It is an analytical device used for the detection of bio chemical substance. It gives the information the bio-composition, structure and function and a biomolecule substance converting a biological response into an electrical signal [1]. Biosensors function by coupling a biological sensing element with a detector system using a transducer. The analytical devices composed of a biological recognition element directly interfaced to a signal transducer which together relates the concentration of an analytic to a measurable response. Biosensors give exciting opportunity for high-impact applications

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