Glass-metal nanocomposites with planar waveguides for biosensor applications

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Abstract

At the present time, optical properties of media containing nanoparticles (NPs) of noble metals is a subject of large number of studies [1]. The possibility of light excitation of localized surface plasmon resonance (LSPR) in metal NPs radically changes properties of dielectric media, due to optical absorption of visible range. The spectral position of LSPR can be controlled by modifying parameters of nanocomposite, giving a possibility to use this kind of media in device applications. Considerable attention is also drawn to nonlinear properties of such composites, particularly due to its high-speed nonlinear response [2].

Presented paper concerns the development of biosensor platform based on silver nanoparticles, synthesized in glasses of two types: in UV irradiated photo-thermo-refractive glasses and in sodium-borosilicate glasses treated in water atmosphere. Glasses with silver nanoparticles are good candidates for creation of biosensors employing the phenomenon of LSPR effect with planar waveguides circuits for excitation and for detection of plasmon resonance shift [3]. The optical and structural properties of nanocomposites obtained by two different methods are investigated.

Two methods of creation of optical waveguides are examined such as thermal diffusion and ion-exchange. The exploitation of planar waveguides in subsurface region allows inputting the light into the sensible part of the glass and facilitates the registration of the optical response of the glass. Two methods of optical waveguide creation are examined: by thermal diffusion and ion-exchange. The configuration of localized surface plasmon resonance based biosensor is presented and discussed. The immobilization scheme of D-galactose/D-glucose binding protein on the glass is also presented.

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References

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