Study of an optical salinity sensor based on surface plasmon resonance in the amorphous As_2S_3 thin film structure

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Abstract

The conventional surface plasmonic resonance is realized in a composite structure consisting of a gold film deposited on the base of a prism. As it was demonstrate, the structure was performant for applications as optical sensors of various physical values. In this paper was studied the sensitivity of optical sensors based on plasmon resonance for measuring the salinity of aqueous salt solutions. The conventional plasmonic structure proposed by Kretschmann was based on the evanescent wave that occurs at light light reflection. The surface plasmons excitation method was modified by adding thin film of material with high refractive index, such as amorphous arsenic sulfide (As2S3). The chalcogenide As2S3 film forms plasmonic waveguide, which can maintain several modes of the electromagnetic field. The rutile prism (TiO2) was used for coupling the light with plasmons. The considered wavelength was 1550 nm, which is optimal for infrared fiber optic networks. The resonance angles were calculated for several salt concentrations in the range of 20-40%. It was shown that the resonance angle depends on the salt concentration and the shift is enough for resolve salinity of different concentration. It was established that the sensitivity depends on the film thickness, the highest being for the thickness of 1000 nm.