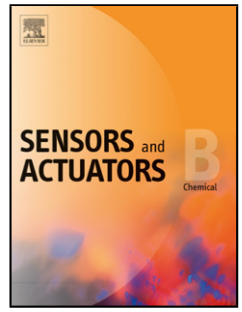

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Author: Partha Sona Maji Mukesh Kumar Shukla Ritwick Das

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Blood component detection based on miniaturized self-referenced hybrid Tamm-plasmon-polariton sensor

Partha Sona Maji[a], Mukesh Kumar Shukla[a], and Ritwick Das*[a]

[a]School of Physical Sciences, National Institute of Science Education and Research, HBNI, Jatni - 752050, India

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Abstract

A self-referenced sensor based on coupled hybrid mode Tamm-plasmon-polariton (TPP) is proposed for detection of different blood group components. The geometry which has been investigated theoretically, is comprised of blood components sandwiched between two 'metal-distributed Bragg reflectors (DBRs)' exhibiting two distinguishable absorption peaks within the photonic band-gap (PBG) of DBR. The two absorption maxima are essentially due to excitation of one symmetric (Mode-I) and one anti-symmetric mode (Mode-II) within the PBG. Mode-I remains invariant for a change of blood constituents whereas Mode-II exhibits strong dispersive properties by virtue of significant presence within the sensing region. This gives rise to a hybrid self-reference scheme where the longer wavelength arm (Mode-II) varies significantly providing proper signature of a particular blood component. A straight line fit to the resonance wavelength shift gives rise to a sensitivity of $\approx 200\ nm/RIU$ with the proposed architecture. The polarization dependence of the spectral shift of hybrid-mode resonance wavelengths for oblique incidence is also investigated and analyzed theoretically. The sharp absorption maxima facilitate precise detection with an improved detection accuracy of a particular blood component. A brief analysis to optimize the sensor design for enhanced sensitivity, as well as detection accuracy, has also been discussed.

Keywords: Biosensors, Plasmonics, Bragg reflectors, Optics at surfaces, Blood components.

*Corresponding author email address: ritwick.das@niser.ac.in