

Title: Design and Investigation of D-Shaped Photonic Crystal Fiber-Based Plasmonic Biosensor

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Abstract: new D-shaped photonic crystal fiber (PCF) based surface plasmon resonance (SPR) sensor has been introduced for refractive index (RI) sensing. The proposed sensor is designed and numerically investigated by the Full Vector Finite Element Method (FV-FEM). It is known, that for the excitation between core and Plasmonic mode chemically stable Plasmonic materials are used very often. Likewise, we have used chemically stable Plasmonic materials Au (gold), Ag (silver), and Ni (nickel) in this model for the comparative sensing observation between the analyte refractive index 1.37–1.40. It is worth mentioning that plasmonic resonance for each material has been rigorously studied. By examining the geometric configuration, sensing results show a maximum wavelength sensitivity (WS) of 32653.06 nm/RIU and amplitude sensitivity (AS) of 3002.56 RIU⁻¹ for the x polarization using an Au (gold) coated layer. The sensor also shows the wavelength sensitivity of 7450.17 nm/RIU and 7357.67 nm/RIU for x polarization and amplitude sensitivity of 1243.065 RIU⁻¹ and 631 RIU⁻¹ for x polarization of Ag (silver) and Ni (nickel) coated layer respectively. The proposed sensor will be able to show the performance variance with different plasmonic materials and help to make decisions in the future for real-time implementation in the relevant areas of applications.

Key words: Refractive index sensing, Full Vector Finite Element Method (FV-FEM)

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