**ABSTRACT**

The technique of Surface plasmon resonance has become a highly influential method for its chemical, bio-chemical and gas sensing applications due to its compactness, flexibility and reliability. A detailed analysis on the performance parameters of SPR based fiber optic sensors having different bimetallic configurations is performed. Two different sensor structures are considered for the study - One having the arrangement consisting of thin layers of Au/Ag with Pd and the other having an alloy layer formed of Au/Ag and Pd nanoparticles. The thickness of the metal layer, its dielectric constants and the thickness, length and refractive index of the sensing layer is properly chosen and the sensitivity evaluation is done. The attenuated total internal reflection method along with Krestchmann configuration has been used to analyze the sensor parameters. The effects of the metal structures considered and its thicknesses on the transmitted spectrum of the proposed sensor is analysed and the best configuration is predicted. The proposed optical model may find its application as a gas sensor.