**ABSTRACT**

 In the present work, a bi-cascaded surface plasmon resonance based fibre optic sensor using various noble metals has been theoretically studied. The attenuated total internal reflection method along with Krestchmann configuration has been used to analyze the sensor. The proposed sensor is bi-cascaded ie., it can simultaneously detect two kinds of chemical substances by using wavelength division multiplexing technology. The sensor 1 is coated with a single layer of Au/Ag thin film of optimised thickness 50nm and the sensor 2 is coated with Pd/Pt/Ir thin films of optimised thickness 10nm 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 effects of the metals considered and its thicknesses on the transmitted spectrum of the bi-cascaded sensor have been discussed and the calculations show that the cascaded sensor produces two resonance dips with a greater difference. It provides reasonable values of performance parameters and hence finds application as a good chemical/gas/biosensor.