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Optimal Configuration for Polarimetric Surface Plasmon Resonance Sensors

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Abstract : Conventional spectroscopic surface plasmon resonance (SPR) sensors are widely used, both in fundamental research and environmental monitoring as well as healthcare diagnostics. However, they still lack the low limit of detection (LOD) and there still a place for improvement. SPR conventional sensors are based on the detection of a dip in the reflectivity spectrum which is relatively wide. To improve the performance of these sensors, many techniques and methods proposed either to reduce the width of the dip or to increase the sensitivity. Together with that, profiting from the sharp jump in the phase spectrum under SPR, several works suggested the extraction of the phase of the reflected wave. However, existing phase measurement setups are in general more complicated compared to the conventional setups, require more stability and are very sensitive to external vibrations and noises. In this study, a simple polarimetric technique for phase extraction under SPR is presented, followed by a theoretical error analysis and an experimental verification. The advantages of the proposed technique upon existing techniques will be elaborated, together with conclusions regarding the best polarimetric function, and its corresponding optimal metal layer range of thicknesses to use under the conventional Kretschmann-Raether configuration.

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