Surface plasmon resonance sensor using spectral interference

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This paper presents a novel surface plasmon resonance (SPR) sensor based on white-light spectral interferometry. The experimental arrangement employs a white-light source (bandwidth from 350 nm to 1000 nm), a polarizer and a birefringent quartz crystal for SPR excitation. SF10 Kretschmann SPR sensor prism is inserted into the beam path and one measures both the corresponding SPR phase change and reflectivity at a suitable fixed angle of incidence across the visible spectrum. The prism (sensing surface) is coated with gold film of 44 nm nominal thickness and the incident angle is approximately 58°. In our case of the SPR effect, the useful phase information is encoded in the spectral interferogram. Thereby, p- and s-polarized spectra interfere among themselves and the interferograms are obtained by using an analyzer when only p-polarized waves are affected by the SPR effect.

Spectral interference signals are then used in corresponding phase retrieval [1]. In order to calculate the SPR induced differential phase change, a windowed Fourier transform (WFT) [2] was adopted to extract the phases from two spectral interferograms, one corresponding to the reference material and the other corresponding to the analyte.

The pilot measurements were tested with water as an analyte and air as a reference material and the measurement results were compared with the results of theoretical models. The first results show good agreement between a calculated resonance wavelength and a resonance wavelength determined from reflectivity measurements. The second results show good agreement for phase change measurements. The proposed technique offers a much simpler experimental arrangement than was recently presented in a paper [3].

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