

Enhancing the evanescent field in TiO₂/Au hybrid thin films creates a highly sensitive room-temperature formaldehyde gas biosensor

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Discovery of the relationship between disease and the Volatile Organic Compounds (VOCs) contained in respiratory gas in human bodies has led to the development of analytical methods and detection systems that can be used for diagnosis. Recent studies, however, have encountered problems using these diagnostic tools when operation temperatures are too high and the detection range of the gas concentration falls beyond the limits of diagnosis criteria. In this study, we propose a highly sensitive surface plasmon resonance biosensor that is based on an enhanced evanescent wave technique and can be operated at room temperature for the detection of formaldehyde. The detection of formaldehyde was chosen to test this concept, because formaldehyde is a known breast cancer biomarker that exists in human exhalation. When the interface of our sensing system was exposed to formaldehyde, the interaction between the ligand and the analyte produced changes in the SPR profiles of the gold thin film. The linear range of the detection system was 0.2 ~ 1.8 ppm with limits of detection at 0.2 ppm. The diagnostic criteria suggest this method could be applied to biological monitoring and diagnostics.