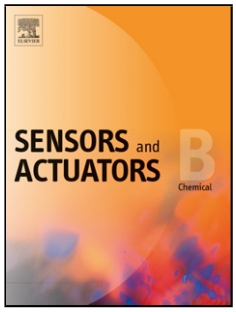

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Highly sensitive Mach-Zehnder interferometer biosensor based on silicon nitride slot waveguide

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Abstract

We demonstrate a highly sensitive label-free Mach-Zehnder interferometer (MZI) biosensor based on silicon nitride slot waveguide. Unlike the conventional MZI sensors, the sensing arm of the sensor consists of a slot waveguide while the reference arm consists of a strip waveguide. Thanks to the slot waveguide's property to provide high optical intensity in a subwavelength-size low refractive index region (slot region), which allows high light-analyte interaction, higher sensitivity can be obtained as compared to conventional waveguides using the slot waveguide as sensing region. The bulk refractive index sensitivity of the slot waveguide MZI sensor was found to be 1864 π/RIU (refractive index unit) with 7 mm long slot waveguide sensing arm, which shows higher sensitivity compared to the conventional MZI device based on silicon nitride. The biosensing capability of the developed slot waveguide MZI was investigated using biotin-streptavidin binding as a model system. The sensitivity of the system was demonstrated down to 18.9 fM or 1 pg/ml of streptavidin solution and to the best of our knowledge, it is the best reported experimental value for the limit of detection of a MZI sensor. Furthermore, we investigated the specific detection and quantification of the methylation of *DAPK (Death-*