INTEGRATED SLOT-WAVEGUIDE MICRORESONATOR FOR BIOCHEMICAL SENSING

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A novel integrated biochemical sensor based on a slot-waveguide [1] microring resonator is demonstrated. The microresonator is fabricated on a Si_3N_4/SiO_2 material platform [2] by using conventional microfabrication techniques, such as Si thermal oxidation, chemical vapour deposition, electron-beam lithography and reactive ion etching. The sensor consists of a 70-μm-radius ring resonator formed by a slot-waveguide [1] having a slot-width of 200 nm. The operation wavelength is 1.3 μm. The device is exposed to different water-ethanol solutions and its transmission spectrum is measured. A linear shift of the resonant wavelength with increasing ambient refractive index of 212 nm/refractive index units (RIU) is observed. This value is more than twice larger than those of strip-waveguide ring resonator biochemical sensors, indicating that higher analyte-probe light interaction occurs in our slot-waveguide sensor as compared to those based on conventional strip waveguides. The sensor detects a minimal refractive index variation of $2x10^{-4}$ RIU, limited by the wavelength resolution of the light source (50 pm). Simulations indicate that the slot region is partially filled when the sensor is exposed to an aqueous solution. We also demonstrate the capability of our sensor to measure higher index fluids such as isopropanol (n=1.37) and cyclohexane (n=1.42).

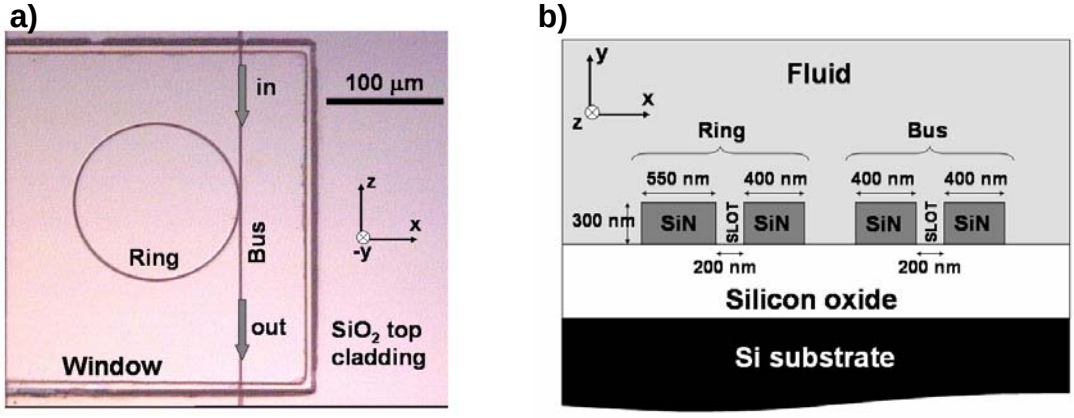

Fig.1. a) Optical microscope top view photograph of a fabricated slot-waveguide ring resonator. A window is opened in the top cladding SiO_2 over the ring to expose the sensor to different liquids. b) Schematic cross-section of the coupling region between the bus and the ring slot-waveguides.

[1] V. Almeida, Q. Xu, C.A. Barrios and M. Lipson, *Opt. Lett*,. 29, 1209-1211 (2004).
[2] C.A. Barrios, B. Sánchez, K.B. Gylfason, A. Griol, H. Sohlström, M. Holgado and R. Casquel, *Opt. Express*, 15, 6856-6856 (2007).