

# 集成光学传感器 Integrated Optical Sensor

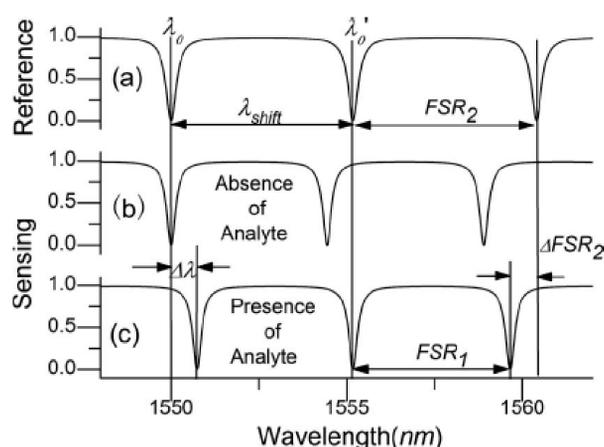
## Introduction

Optical biosensors, leveraging off the natural high speed and sensitivity, have attracted considerable interests, and among the existing optical biosensors, microring resonator biosensor shows promising because of its robustness, label-free detection mechanism, mature CMOS fabrication technology, low cost and high sensitivity achieved by the long lifetime of photons that circle in the ring, which increases the probability of photons interacting with analytes. We are working on the microring resonator biosensors with sensing theory and practical experiment.

## High sensitive theory

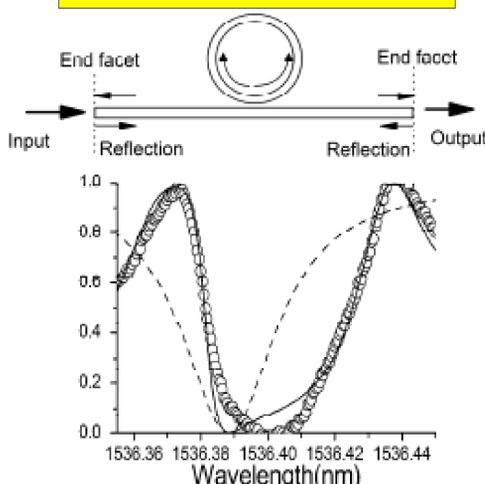
The optical resonance can provide high sensitivity sensing performance in theory. We are making a progress to enhance the sensitivity and make it practical in integrated silicon devices.

### Multi-Resonance shift



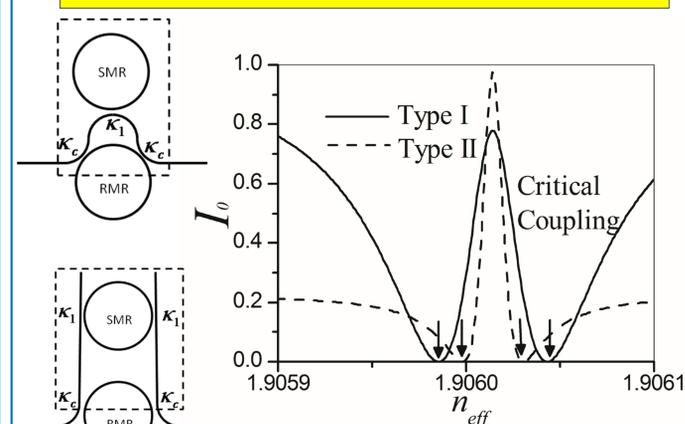
The multi-resonances sensing scheme is investigated to get a significantly shift of the resonance wavelength.

### Fano resonance



The Fano resonance based on the single silicon microring resonator is obtained, which can provide steeper wavelength dependence transmission for intensity sensing scheme.

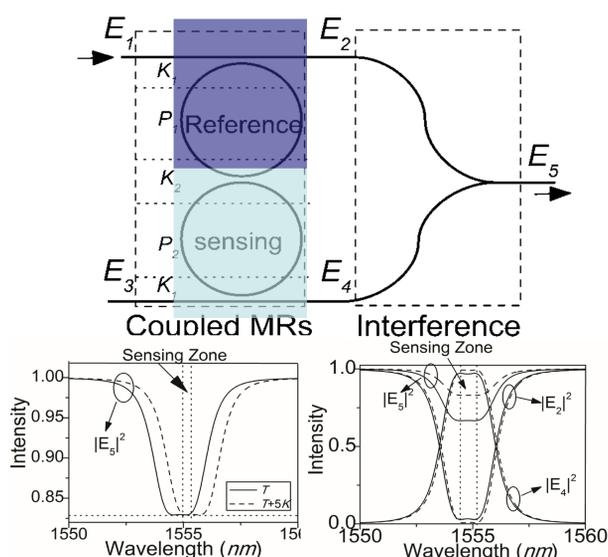
### Coupling-induced sensing



The coupling-induced sensing mechanism can relax the requirement of the ultra-narrow, which can provide steeper wavelength dependence transmission for intensity sensing scheme.

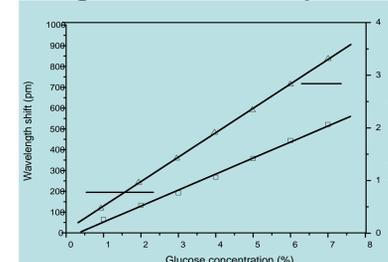
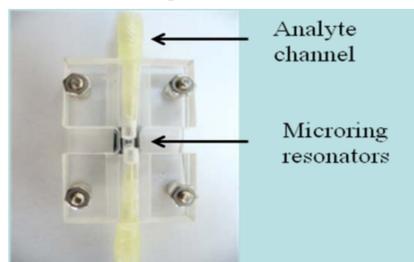
## Athermal Sensing

The temperature influence can destroy the optical sensing device' performance. We presents a CMOS-compatible thermal-independence microring resonator sensor within  $\pm 5^\circ\text{C}$  range.



## Sensing experiment

The silicon nitride ( $\text{Si}_3\text{N}_4$ ) microring resonator was designed and fabricated with CMOS process. The scale of the device is about  $400\ \mu\text{m} \times 400\ \mu\text{m}$ . Then, the microring sensor device was packaged to work with liquid fluid control, which has high sensitivity as  $10^{-4}$  RIU.



## Publication

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- H. Yi, D. S. Citrin, Y. Chen, and Z. Zhou, *Applied Physics Letters*, 95, 191112 (2009).
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