

# Chemical Sensing by RIFTS-Reflective Interferometric Fourier-Transform Spectroscopy: A Robust, Self-Compensating Method for Label-Free Detection of Biomolecules

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## BACKGROUND

Most optical transducers for label-free biosensing involve measurement of a change in the refractive index of a material induced upon analyte binding. While surface plasmon resonance (SPR) films, resonant and nonresonant diffraction gratings, reflectometric interference (RIFS) layers and Fabry-Perot interferometers show very sensitive responses to small changes in refractive index, these methods are all limited by zero-point-drift arising from changes in temperature, matrix composition, or nonspecific binding to the analytical surface.

A double-beam (Michelson-type) interferometer, in which one optical path acts as a reference channel, provides an excellent means of compensating for such effects. Various implementations of double-beam correction have been employed in micro-scale biosensor systems, generally involving two spatially distinct regions of a chip. However, because the sample and reference channels are separated in the X-Y plane, such designs pose significant alignment and manufacturability challenges, especially upon incorporation into high-throughput arrays.

## TECHNOLOGY DESCRIPTION

This invention utilizes a novel self-compensating interferometric biosensor comprised of two layers of porous SiO<sub>2</sub>, stacked one on top of the other. The reflectivity spectrum displays a complex interference pattern that arises from a combination of Fabry-Pérot interference from these layers. A ratio of the peak intensities in the fast Fourier transform (FFT) allows discrimination of target analyte from matrix effects arising from non-specific compositional changes in the analyte solution.

## APPLICATIONS

Label-free biosensing, high-throughput molecular sensing, array-based sensing, drug lead discovery, diagnostics, and characterization of kinetic and thermodynamic binding constants in biomolecular binding assays.

## ADVANTAGES

The approach is very general. For example, the methodology should also work with other label-free transduction modalities in materials other than porous SiO<sub>2</sub> or porous Si that utilize refractive index changes, such as surface plasmon resonance or microcavity resonance. The built-in reference channel and Fourier method of analysis provides a general means to compensate for changes in sample matrix, non-specific binding, temperature, and other experimental variables.

## STATE OF DEVELOPMENT

The concept has been demonstrated with a Protein A capture probe and Human Immunoglobulin G as the target analyte. The system response is shown to be insensitive to the addition of 4000-fold excess sucrose or 80-fold excess bovine serum albumin.

## RELATED MATERIALS

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## OTHER INFORMATION

### KEYWORDS

porous silicon, biosensor, photonic crystal, optical biosensor, interferometric biosensor, chemical sensor

### CATEGORIZED AS

- Biotechnology
  - Genomics
  - Proteomics
- Medical
  - Diagnostics
  - Other
  - Research Tools
- Nanotechnology
  - NanoBio
  - Research Tools
  - Nucleic Acids/DNA/RNA
  - Screening Assays

### RELATED CASES

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See Professor Michael Sailor's June 2005 [Smart Dust](#) presentation.  
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## INTELLECTUAL PROPERTY INFO

A patent application is pending.

## PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,909,985	03/06/2018	2005-179

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