Methods and Apparatus of Measuring a Change in Thickness of an Objection of Interest with Picometer Accuracy

Tech ID: 34606 / UC Case 2026-377-0

ABSTRACT

Researchers at the University of California, Davis have developed a method and apparatus for precise, label-free measurements of reactions at a molecular or near atomic level using an oblique-incidence optical analysis technique.

FULL DESCRIPTION

This technology utilizes an oblique incidence broadband light source and spectrometers to measure interference patterns created by reflections from the surfaces of a thin dielectric layer deposited on a transparent support structure such as a glass slide. By spatially separating reflections and compensating for spectral fluctuations, ultra-sensitive thickness measurements down to the picometer scale can be achieved. The approach improves signal-to-noise ratio and measurement sensitivity compared to traditional normal-incidence methods by removing background interference caused by reflections and birefringence in the support structure. It is especially suitable for monitoring biochemical reactions occurring on the thin dielectric layer, enabling real-time, label-free assays in microarray formats without requiring complex temperature control.

APPLICATIONS

- Label-free biochemical assay systems for molecular binding studies on microarrays.
- Pharmaceutical and biomedical research for monitoring drug-protein or pathogen interactions.
- Semiconductor and material science industries requiring precise ultrathin layer thickness measurements.
- Optical metrology tools in chemical and biochemical reaction studies on solid supports.
- Development of diagnostic devices employing sensitive surface-bound reaction detection.
- Research and development in nanotechnology and thin film characterization.

FEATURES/BENEFITS

- Detects thickness changes as low as 1 picometer for ultra-high sensitivity.
- Increases signal-to-noise ratio by spatially separating reflection sources.
- Normalizes data with dual spectrometers to eliminate spectral fluctuations and drift.
- Measures a wide range of thin dielectric layers and materials for versatile applicability.
- Enables rapid, simultaneous analysis of multiple microarray targets.
- Reduces temperature dependence compared to conventional optical metrology techniques.

CONTACT

Andrew M. Van Court
amvancourt@ucdavis.edu
tel: .

INVENTORS

- Zhu, Xiangdong

OTHER INFORMATION

KEYWORDS

analytical, biosensors, biomedical assays, biochemical reaction monitoring, dielectric thin films, interference microscopy, label-free detection, molecular biology, optical metrology, ultra-thin film measurement

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Imaging**
  - Molecular

- Provides label-free, high-precision detection of biochemical binding reactions.
- Accurately measures ultrathin layers on solid supports, overcoming traditional limitations for <few-micron films.
- Mitigates residual birefringence, drifting backgrounds, and noise from unwanted reflections and spectral fluctuations.
- Monitors biochemical reactions at or near the atomic scale on solid substrates without the use of labels.
- Extends sensitivity and range over normal-incidence optical thickness metrology, supporting broader applications.

PATENT STATUS

Patent Pending

- **Materials & Chemicals**
  - Thin Films
- **Sensors & Instrumentation**
  - Analytical
  - Biosensors
  - Scientific/Research

RELATED CASES

2026-377-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Method for Simultaneously Measuring In- and Out-of-Plane Surface Magnetic Properties of Thin Films

University of California, Davis
Technology Transfer Office
1 Shields Avenue, Mrak Hall 4th Floor,
Davis,CA 95616

Tel:
530.754.8649
techtransfer@ucdavis.edu
https://research.ucdavis.edu/technology-transfer/
Fax:
530.754.7620