Rapid label-free diagnostics for biomedical applications using advances in optics nanotechnology

Debra Wawro[1] and Peter Koulen[2]

[1]Resonant Sensors Incorporated (RSI), 416 Yates Street, 518 NH, Arlington, TX USA 76010
[2]University of Missouri – Kansas City, School of Medicine, Departments of Ophthalmology and Basic Medical Science, Vision Research Center, 2300 Holmes Street, Kansas City, MO USA 64108

Summary:

A new highly sensitive sensor technology has the potential to simplify medical diagnostic tests by significantly reducing operation complexity compared to standard tests such as enzyme-linked immunoassays. Sensor elements are fabricated from low-cost polymers and pre-sensitized to detect an array of agents related to the disease. These elements are disposable and designed to operate tag-free using patient samples without pre- or post-chemical processing. Picomolar concentrations for a wide variety of analytes, including proteins, drugs, bacteria, viruses, and DNA can be measured. Additionally, the sensor system design utilizes low-power laser diodes and detector arrays in a compact format allowing for enhanced portability. The heart of this new sensor technology is the guided-mode resonance (GMR) effect that occurs in sub-wavelength waveguide gratings. When these sensors are illuminated with a light source, a specific wavelength of light is reflected at a particular angle. Interaction of a target analyte with a biochemical layer on the sensor surface yields measurable angular shifts that directly identify the binding event without additional processing or foreign tags. Since the resonance layer is polarization sensitive, separate resonance peaks occur for incident polarization states. This property provides cross-referenced data points that can be

used to calibrate for variations such as temperature or sample background and to reduce the probability of false readings.