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Non-Confidential Description - PSU No. 4262
"Planar Dielectric Waveguide for Enhanced Total Internal Reflection Fluorescence Microscopy"

Keywords:

planar waveguide, TIRFM, dielectric thin film, evanescent wave, biosensors.

Inventor:

Thomas Jackson, *et al*.

Links:

http://www.bioe.psu.edu/labs/Hancock-Lab/index.html

Background

The growth of single-molecule total internal reflection fluorescence microscopy (TIRFM) has been enabled by technical advances in the fields of optics, materials science, and chemistry, leading to its adoption as the standard technique in numerous fields. Development of high quantum yield fluorophores has allowed for the high precision tracking of single molecular motors in vitro. The primary limitation to TIRFM is the low number of photons that reach the detector from a single fluorophore, which restricts the temporal resolution of imaging experiments. This new technology is a novel dielectric waveguide designed specifically for use in existing commercial TIRF microscopes that can overcome these difficulties and increase resolution, without resorting to increasing laser incidence power.

Invention Description

This technology employs multiple thin layer films deposited in a planar fashion on top of the glass cover slip. These layers are selected to optimize the energy passed into the evanescent wave at a designed resonance angle. A resonance effect along the waveguide lateral direction leads to enhancement of evanescent excitation. The use of a waveguide has been demonstrated to increase the signal intensity from fluorescent probes by over an order of magnitude relative to a standard glass cover slip. The coupling angle is specifically designed to be accessible by many objectives, thus eliminating the need for expensive, very high numerical aperture objectives in TIRFM.

Advantages / Applications

- Enhances resolution of imaging
- Reduce the use of expensive numerical aperture objectives in TIRFM
- Designed specifically for use in existing TIRF microscopes
- Further benchmarked by use of well-developed single-molecule kinesin motility assays

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