Integration of New Hybrid Materials Containing Biomolecules for the Fabrication of Optical Sensor Systems

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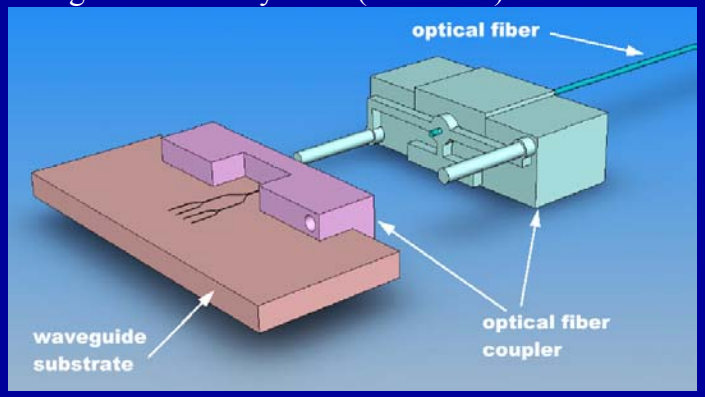
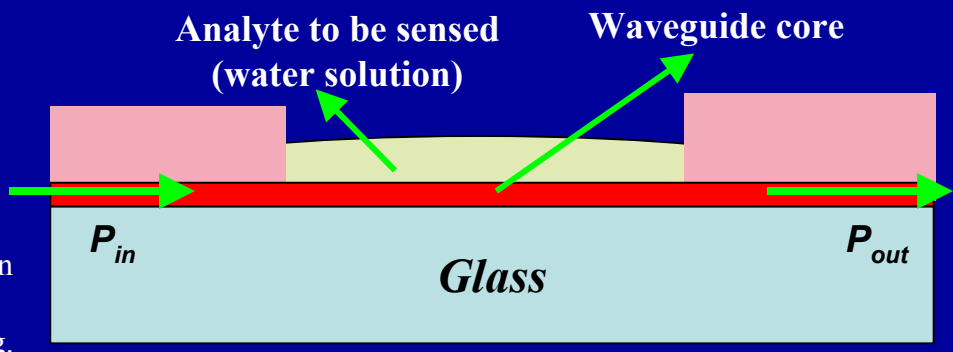
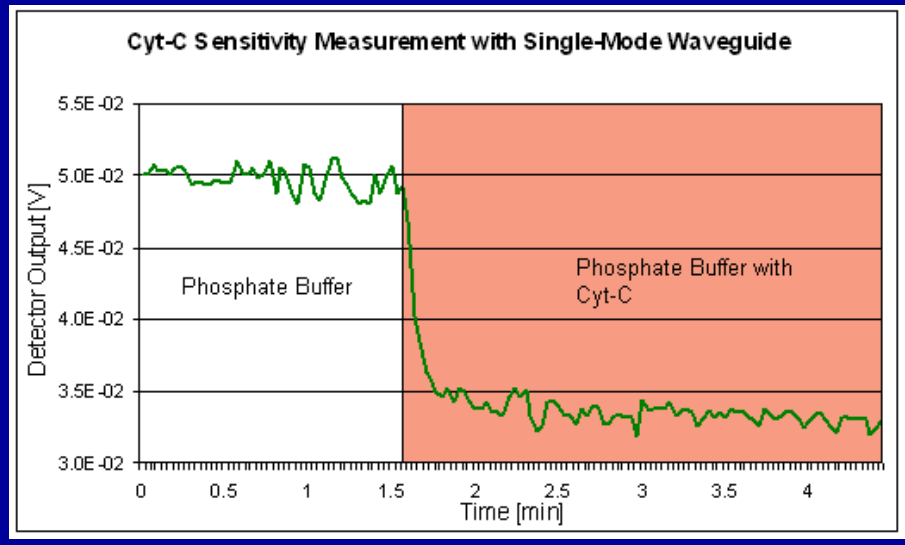
We are employing a unique planar, guided-wave optics approach to develop integrated-optic chemical and biological sensors. We have experimentally demonstrated ultra-sensitive detection of a fraction of protein monolayer in our waveguide device. The waveguide configuration combines a glass channel structure and a sol-gel cladding film. The waveguide is exposed to analytes through openings in the sol-gel cladding. With a 5 µM of horse heart cytochrome-c dissolved in phosphate buffer solution at the waveguide superstrate, a half monolayer was formed on the hydrophylic silica surface of the waveguide. By using a wavelength tuned to cyt c absorption band (532 nm) we measured a decrease of 30% in the device transmission. For a control signal (633 nm) outside the cyt c absorption band, the transmission remained unchanged when propagating through the same channel. Furthermore, the sol-gel cladding can be used to define alignment features for self-aligning the input and output fibers for ultra low-cost integrated sensor systems (see below).



Schematics of the waveguide sensor



Change in transmission due to Cyt-C injection



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Education

- Four Graduate students and two postdoctoral associates are directly involved in the project

Outreach to Native American Communities

- Pre-College Outreach Activity: Dine' Community College in Tsaile, AZ - Navajo Reservation, taught basic Science classes for six weeks, summer of 2004 by three graduate students
- Taught optics to high school students from predominately Spanish American Tucson Unified School District for one week in summer of 2004
- Pre-College Outreach Activity: Many Farms High School Navajo Reservation campus visit of the University of Arizona in March 2003
- Pre-College Outreach Activity: Kellond Elementary 2nd Graders - Tour of Optical Sciences Building and labs at the University of Arizona in April 2003

Tucson Unified School District - Second Grade
K-12 Outreach Program,, 2003

Dine` Community College Students, Tsaile, AZ Navajo Nation,*Native American Outreach Program, 2003*