

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

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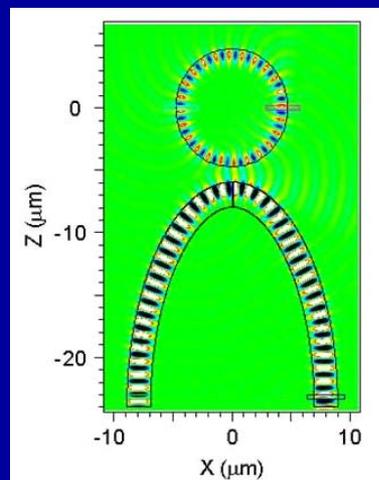
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NSF: DMR 0099862

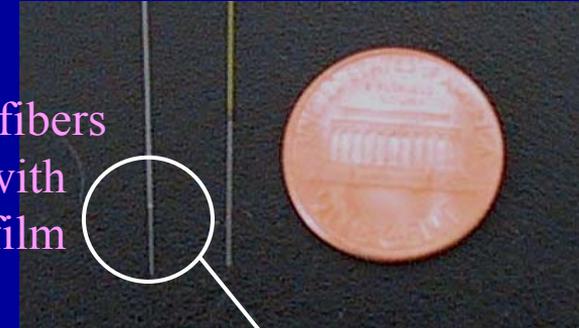
We are extending the unique capabilities of biomolecule doped sol-gel materials to biomedical sensors for homeland security and other applications. We created a sol-gel sensing approach to detect glutamate, a major excitatory neurotransmitter. The glutamate is detected optically, using the luminescence that results from an enzymatic reaction with glutamate dehydrogenase. This approach is highly selective for glutamate and is sensitive to physiological levels. The figures at the right show the integration of sol-gel coatings with fiber optics. In this configuration, sol-gel sensors can be applied to both *in-vitro* and *in-vivo* experiments.

We also designed and performed numerical simulations for a waveguide disk resonator that shows more than 300 times sensitivity enhancement compared with traditional schemes

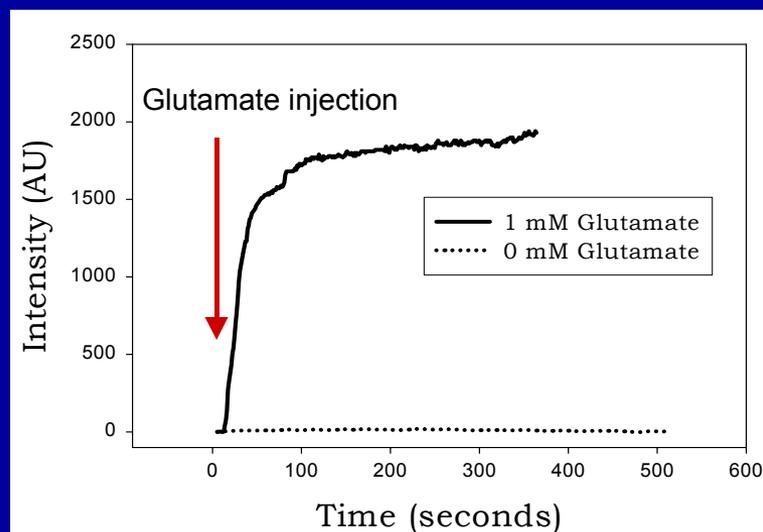
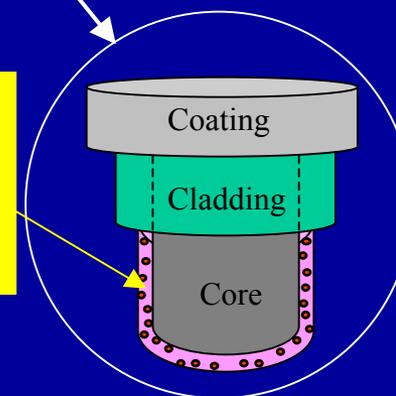


Design of a waveguide disk resonator with enhanced sensitivity

Optical fibers coated with sol-gel film



Sol-gel film containing glutamate dehydrogenase



Luminescence signal in an optical fiber from enzymatic reaction with glutamate

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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 visit in Tsaille, AZ - Navajo Reservation in February 2003**
- **Pre-College Outreach Activity: Dine' Community College campus visit of the University of Arizona in March 2003**
- **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, March, 2003**



**Dine' Community College Students, Tsaille, AZ  
Navajo Nation, Native American Outreach Program  
February, 2003**