Indiana Section of the Society for Applied Spectroscopy

March / April 2001 Newsletter

ISSAS 2000-2001 SEMINARS

The third Indiana Section of the Society for Applied Spectroscopy seminar was held on Monday, February 5, 2001. This seminar featured the work of Dr. David R. Walt from Tufts University, who presented his research on optical fiber chemical sensors. We would like to thank Dr. Walt and all who attended this seminar at the Indiana University Chemistry Department.

The final seminar in the 2000-2001 series will feature this year's SAS National Tour Speaker. Dr. Dan Feldheim from North Carolina State University will be speaking about his research on hybrid organic-metal nanoparticle composites for nanoscale electronics and biotechnology. This seminar will be held at the Indiana University Chemistry Building (Room C127) at 6:00pm on Monday, April 16, 2001. Dinner with Dr. Feldheim will be held after the meeting at Michael's Uptown Cafe. If you are interested in attending the dinner, please RSVP to Denise McClenathan (dmcclena@indiana.edu) by Thursday, April 12.

NEWS IN SPECTROSCOPY

Optical Biosensor for DNA Mismatch Detection: As genomic research has gained momentum, assays for single nucleotide polymorphisms (SNPs) have received increased attention. Nakatani and colleagues have designed an optical assay for the detection of SNPs by synthesizing a specific ligand that binds exclusively to G-G mismatches. By covalently attaching the ligand to a substrate, subsequent binding of DNA target sequences was detected by surface plasmon resonance. This non-gel based method provided detection of SNPs without prior knowledge of the DNA base sequences involved. (*Nat. Biotech.* **2001**, *19*, 51-55)

Visual Determinations of Nucleic Acid Sequences: Currently, many assays are available that detect nucleic acids hybridized to complementary

sequences. However, these methods often require expensive or complex instrumentation to visualize the results. A team of researchers at *BioStar Inc.* recently described a nucleic acid assay with a substrate composed of an optically coated silicon surface. After hybridization of the target sequence with a biotin labeled complement, an anti-biotin tagged horseradish peroxidase enzyme is used. If a precipitating substrate for the peroxidase is introduced, a thin film is formed on the surface of the substrate. The additional molecules cause a change in the pathlength at the sensor surface, causing visible changes in the wavelength of light reflected. (*Nat. Biotech.* **2001**, *19*, 62-65)

Laser Ablation Under a Water Film: Laser ablation is a popular method for solid sample introduction in mass spectrometry, as well as an option for microfabricating on substrates. Zhu and coworkers have recently studied a simple method for increasing the efficiency of the ablation process. By covering a silicon substrate with 1 mm of water, ablation depth was found to increase across a range of laser powers. Furthermore, the profile of the under water ablated crater was shown to be wider and the crater walls steeper than when performed in air. The researchers hope this technique will provide a simple improvement in the quality of microchip devices. (*J. Appl. Phys.* **2001**, *89*, 2400-2403)

THIS MONTH IN SPECTROSCOPY

In April 1976, Tomas Hischfeld reported the detection of fluoresceine isothiocyanates bound to one polyethyleneimine (MW~20,000) that was also linked to one γ-globulin. This was the first report of what technique?

In an article published in the December 1976 issue of *Applied Optics*, Tomas Hirschfeld used a newly developed fluorescent tagging method and illumination procedure to observe individual small molecules visually and photoelectrically with an optical microscope. In this study, between eighty and one hundred fluorosceine isothiocyanate molecules were bound to one polyethyleneimine (MW 20,000) and one γ globulin. Upon illumination of this reagent at light intensities high enough to provide complete photobleaching, this species was detected as a short fluorescence pulse. To measure the light pulses from individual molecules, background sources (which include scattering from the laser and fluorescence from the microscope slide) had to be eliminated. Flourescence pulses from these molecules were observed to be

approximately 2 ms in duration. These studies were among the first that demonstrated the capability of rapid optical detection of single molecules.

Spectroscopy Trivia:

In June of 1948, A. E. Cameron and D. F. Eggers, Jr. described the development of what type of mass spectrometer?

The answer to this question can be found in next the addition of "This Month in Spectroscopy" or log on to the ISSAS trivia page at http://www.indiana.edu/~issas/trivia.html.

ISSAS ONLINE

Please remember to check out our website! The ISSAS homepage will keep you updated on local section and national events as well as provide information about our corporate sponsors. Please visit our site at http://www.indiana.edu/~issas.

If you have a non-commercial spectroscopy related website that you would like us to link on our web page please contact Denise McClenathan at dmcclena@indiana.edu.

NEW MEMBERSHIPS

Your local Indiana Section of the Society for Applied Spectroscopy is looking for new members. We invite you to recommend membership to any of your colleagues or students who you may feel would benefit from membership in such an organization. The fee for joining is very reasonable for both professionals and students alike. Membership also includes a subscription to the journal *Applied Spectroscopy*. For further information on ISSAS membership, please feel free to contact us or visit our website at http://www.indiana.edu/~issas.

CONTACT INFORMATION

You may contact any of the ISSAS officers via phone (812) 855-7905, email (issas@indiana.edu), fax (812) 855-0958, or write to:

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Indiana Section of the Society for Applied Spectroscopy
2000-2001 Seminar Series

HYBRID ORGANIC-METAL NANOPARTICLE COMPOSITES FOR NANOSCALE ELECTRONICS AND BIOTECHNOLOGY

Dr. Dan Feldheim

Department of Chemistry, North Carolina State University
Raleigh, North Carolina 27695
http://www.ncsu.edu/chemistry/dlf.html

Two important technologies to emerge from the next century will be nanoscale electronics and gene therapy. These seemingly disparate areas of science, one traditionally rooted in physics, the other in biology, are linked by a need for multifunctional, nanoscopic composite materials. Gene delivery would benefit from a single nanoscopic material capable of packaging DNA, selectively entering specific cells and releasing the DNA into the cell nucleus. Materials for nanoscale electronics must not only contain the desired electrical characteristic, but must also be capable of "self-assembling" into more complex functional integrated circuits.

Our group has developed methods for synthesizing a variety of polymer- and alkylthiolate- modified metal nanostructures (e.g., 1 nm - 200 nm gold particles) and hollow polymer nanocapsules. In this presentation, the electronic properties of individual metal nanoparticles will be described. Our specific goals are to establish basic surface chemistry—nanoparticle electronic property relationships. In addition, entrapment and diffusion of small molecules inside hollow polymer capsules will be presented within the context of drug, gene delivery, and enzyme immobilization.

6:00pm
Monday, April 16, 2001
Chemistry Building Room C127
Indiana University
Bloomington, IN 47405

Post-Seminar Dinner with
Dr. Dan Feldheim

Monday, April 16, 2001

Seminar	Dinner
Chemistry Building, Rm. C127	Michael's Uptown Cafe
Indiana University	102 East Kirkwood Ave.
Bloomington, IN	Bloomington, IN
6:00pm	7:30pm

For dinner, please RSVP to Denise McClenathan
(issas@indiana.edu or (812) 855-7905) by Thursday, April 12.

Biographical Sketch

Dan Feldheim is an associate professor of chemistry at North Carolina State University. He received his B.A. degree in chemistry from San Jose State University and his Ph.D. from Colorado State University. Professor Feldheim held a NSF post-doctoral fellowship at Pennsylvania State University under the advisorship of Thomas E. Mallouk where he developed and characterized inorganic polymer/Au colloid thin film assemblies. He subsequently joined the faculty at North Carolina State University, where he served as an assistant professor from 1997-2001 and currently is an associate professor. Dr. Feldheim has received numerous awards and honors, including the David and Lucille Packard Foundation Award (2000), National Science Foundation Career Award (2000), Arnold and Mable Beckman Young Investigator Award (1999), the Society of Electroanalytical Chemistry Young Investigator Award (1999), and a Research Corporation Research Innovation Award (1998). Dr. Feldheim's research interests include nanoscale electronic devices and chemical sensors and the synthesis of nanocapsules for drug delivery, gene therapy, and bioencapsulation.