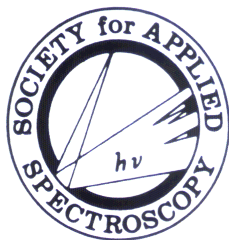


# Indiana Section of the Society for Applied Spectroscopy

## January/February 2000 Newsletter

### ISSAS 1999-2000 SEMINARS

The Indiana Section of the Society for Applied Spectroscopy hosted its second seminar in the 1999-2000 series with a talk given by Dr. Marc D. Porter in November. Dr. Porter spoke on the use of infrared spectroscopy and force microscopy to study organosulfur monolayers on gold. Thank you Dr. Porter and all who attended.

Our next speaker in the seminar series is Dr. David M. Hercules from Vanderbilt University in Nashville, Tennessee. Dr. Hercules will be discussing mass spectrometry of block copolymers. The seminar will be held in Bloomington at the Indiana University Chemistry Building (A400) at 6:00 p.m. on Thursday, February 17, 2000. A dinner will be held with Dr. Hercules after the meeting at Janko's Little Zagreb. If you are interested in attending the dinner with Dr. Hercules, please RSVP Andrew Leach by February 15.

We still have two excellent speakers remaining in this year's seminar series. Dr. Raoul Kopelman at the University of Michigan will be speaking on April 6, 2000. This year's ISSAS national tour speaker will be Dr. Evan Williams. The date for this seminar has yet to be determined.

### SPECTROSCOPY NEWS

The November 19 edition of *Science* contains a section entitled "Frontiers in Optics" where multiple reviews of developing optical technologies are presented. Femtosecond pulse generation and nonlinear optical devices, which have already found multiple applications in spectroscopy, are two technologies discussed in these reviews. The "Frontiers in Optics" section also outlines recent advances in photonic crystals, which may prove to be the fiber optic of the future. [*Science,* **286** (1999) 1499]

## THIS MONTH IN SPECTROSCOPY

*What technique, developed in 1985, combines scanning tunneling microscopy (STM) with stylus profilometry (SP) to achieve atomic resolution for insulators?*

**1985:** G. Binnig, C.F. Quate and Ch. Gerber combined the scanning tunneling microscope (STM) with stylus profilometry (SP) to develop the atomic force microscope (AFM) [*Phys. Rev. Lett.,* **56** (1986) 930]. This new microscopy system was developed as a logical evolution of the STM, invented four years earlier by Binnig and Gerber in collaboration with H. Rohrer and E. Weibel [*Phys. Rev. Lett.,* **49** (1982) 57]. STM revolutionized the study of conducting species by producing surface images with unprecedented resolution. For their work regarding the STM, Binnig and Rohrer received the 1986 Nobel Prize in Physics (http://mirror.nobel.ki.se/laurates/physics-1986.html). Atomic force microscopy combines the ultrahigh resolution of STM with the insulator imaging capabilities of SP.

Spectroscopy Trivia:

*What revolutionary class of imaging detectors was developed in 1970 based upon the storage and controlled movement of charge (information) in potential wells on the surface of a semiconductor?*

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.

## GOVERNING BOARD MEETING

The SAS Governing Board met October 26, 1999 at the Waterfront Centre Hotel in Vancouver during The 26th Annual Conference of the Federation of Analytical Chemistry and Spectroscopy Societies. Twenty-one SAS local sections were represented.

We would like to thank Dr. Patricia Lang from Ball State University for representing the ISSAS at the meeting. Here are the highlights she reported:

(1) The treasurer reported that the SAS is in the black!

(2) During the presentation of the Constitution and Bylaws Committee Report it was proposed that Section 5(c) be amended from will be privileged to have their logo on the Masthead page of Applied Spectroscopy to will be privileged to have their logo featured in Applied Spectroscopy to allow the editor with

more flexibility in design. This was approved.

(3) During the Local Section Affairs Report it was noted that that an effort should be made to alert local sections to nominate graduate students for the Graduate Student Award. There were only three students nominated this past year. The criterion for the Graduate Student Awards will also be sent out with the call for the award.

(4) During the FACSS Delegate Report it was noted that the 2000 FACSS conference will be held in Nashville, TN; the 2001, in Detroit; and the 2002, in Providence, RI; The location of the 2003 FACSS meeting was not decided. Suggestions include Ft. Lauderdale, Cincinnati, Cleveland, and Portland. Hawaii was also mentioned.

(5) Marvin Margoshes who works with the Chemical Heritage Foundation asked members to submit ideas for a list of 20 of the most important developments in instrumentation.

(6) The SAS regrets the death of Fred Brech and extends sympathy to Bill Fately on the loss of his son.

(7) The next SAS Governing Board Meeting will be held on Sept. 24, 2000 in Nashville.

## ISSAS ONLINE

You can find your ISSAS homepage at: http://www.indiana.edu/~issas. As always, the ISSAS homepage will keep you updated on local section and national events as well as provide information about our corporate sponsors.

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

## 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, please feel free to contact any of the current officers or visit our website (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:

Society for Applied Spectroscopy - Indiana Section
Department of Chemistry
Indiana University
Bloomington, Indiana 47405

## SPONSORS

The Indiana Section of the Society for Applied Spectroscopy would like give a special thank you to our corporate sponsors who make this newsletter and seminar series possible:

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Indiana Section of the Society for Applied Spectroscopy
1999-2000 Seminar Series

# MASS SPECTROMETRY OF BLOCK CO-POLYMERS

David M. Hercules
Department of Chemistry, Vanderbilt University, Nashville, Tennessee 37235

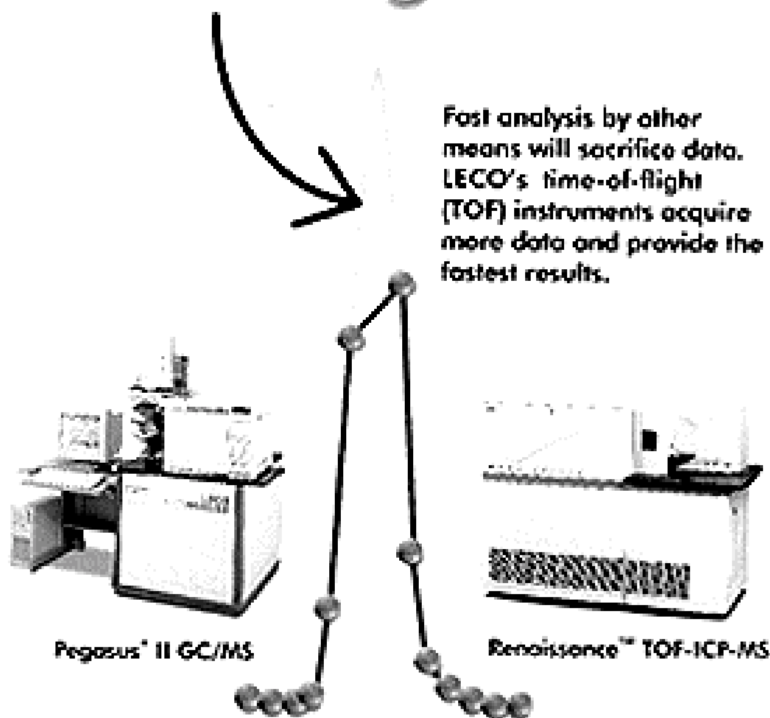
TOF-SIMS has been used to examine the surfaces of symmetric poly(styrene-co-isoprene) (PS-PI) diblock copolymer films on silver. The low mass and high-mass spectral regions were compared. High-mass spectra contain only large silver cationized polyisoprene (PI) fragment ion peaks; no polystyrene (PS) fragment ions are observed. Absolute high-mass ion intensity measurements performed on PS and PI homopolymers show that PS has an 8.8-fold higher ion yield than PI. Since PS has higher ion yield than PI, the presence of only PI fragment ions in the PS-PI diblock spectra is evidence that the PI block forms a surface layer. In the low-mass region, the relative intensities of the characteristic PS and PI peaks indicate that the surface is enriched with PI, but that a detectable amount of PS is also present in the surface region. This contradiction may be interpreted as evidence of greater surface sensitivity of the high-mass region. High-mass ions probably originate from the less energetic and shallower regions within the collision cascade. It is possible to estimate the high-mass escape depth at 5 ≤ Å. Another explanation for the absence of PS fragment ions in the high-mass region is that PI constitutes thinner domains and therefore is preferentially cationized by silver during the collision cascade event. The high-mass region of the diblock spectra contain repeat peak patterns characteristic of PI. The relative intensity of the two most prominent clusters is sensitive to the molecular weight of the PI block. Atomic microscopy (AFM) was used to obtain images of the diblock surfaces. AFM revealed that the topography of the PS-PI diblocks changes with molecular weight.

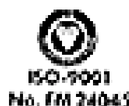
Selective chemical degradation combined with MALDI analysis was used for the characterization of polyether and polyester polyurethanes (PUR's). Two selective chemical degradation reagents were used. Ethanolamine was applied for the recovery of polyether (pTHP) soft-blocks. MALDI analysis of the degraded polymers indicates recovery of a representative oligomer distribution. Allowing only partial reaction enables identification of the diisocyanate; ions containing the urethane linkage are observed in the MALDI spectrum. The polydispersity indices determined by MALDI are in reasonable agreement with the expected values based in the pTHF synthesis reaction.

Phenylisocyanate, which does not cleave ester bonds, was applied for the analysis of polyester PUR's. MALDI showed that the pBA oligomer distribution is recovered, along with minor degradation products containing the urethane linkage, providing identification of both the polyester and the diisocyanate. Comparison of the degraded pBA-PUR oligomer distributions with the unreacted pBA material indicates that smaller oligomers are less abundant in the degraded samples. SEC-MALDI was used to obtain more accurate MWD determinations than MALDI alone. The polydispersity indices determined using SEC-MALDI are higher than MALDI determined PD indices. The results presented indicate that the combination of selective degradation, combined with SEC-MALDI analysis is a viable means for polyether and polyester polyurethane soft-block characterization.

6:00 pm
Thursday, February 17, 2000
Chemistry Building Rm A400
Indiana University, Bloomington, IN

# Pick up your missing data.

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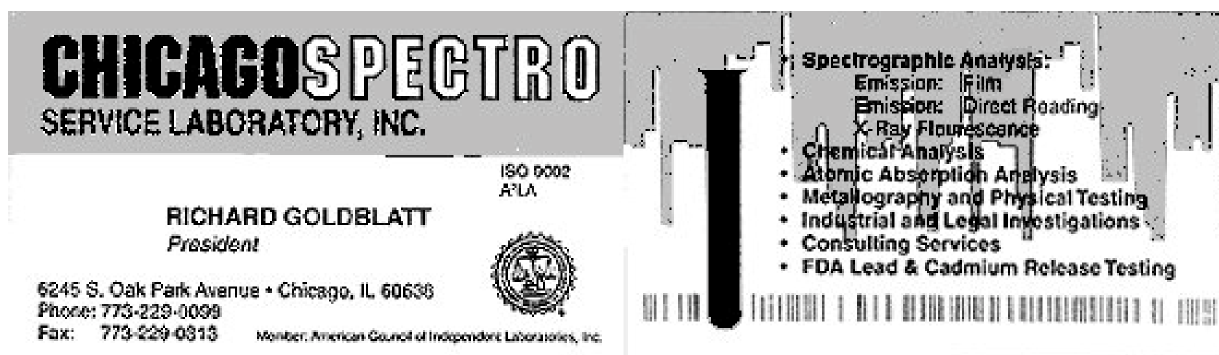
*Biographical Sketch*

**David M. Hercules** graduated from Juniata College with a B.S. in Chemistry on 1954 and received his Ph.D. from M.I.T. in Analytical Chemistry in 1957. His thesis research was performed under L.B. Rogers. From 1957 to 1960 he was a member of the faculty of Lehigh University and from 1960 to 1963 on the faculty of Juniata College. In 1963 he became Assistant Professor of Chemistry at M.I.T., Associate Professor in 1968. In 1969 he became Associate Professor in Chemistry at the University of Georgia, Professor in 1976 and served as Department Chairman from 1980-1989 and as Miles Professor of Chemistry(1989-94). Currently he is Chairman and Centennial Professor of Chemistry at Vanderbilt University.

Dr. Hercules' research interests concern the analytical chemistry of surfaces and solid-state mass spectrometry. This involves such areas as catalysts, polymers, quantitative methodology, surface oxidation and modification, and trace analysis. The major instrumental techniques which he uses are x-ray photoelectron spectroscopy (ESCA), secondary ion mass spectrometry (SIMS), ion scattering spectroscopy (ISS), infrared spectroscopy, Raman spectroscopy, and laser mass spectroscopy. He is heavily involved in laser mass spectrometry of nonvolatile, organic solids and development of the scanning laser microprobe.

He served as a member of the Governing Board of the Council for Chemical Research, the joint Board-Council Committee on Science of the A.C.S., and as a member of the Chemistry Advisory Committee for the National Science Foundation. He is a member of the organization committee for the International Conference on the Analytical Chemistry of Pollutants and was for many years a member of the Pittsburgh Conference Committee. He was awarded the Lester Strock Medal in 1981 by the SAS and the A.C.S. Award in Analytical Chemistry (Fisher Award) in 1986. In 1987 he was also awarded the Benedetti-Pichler Award by the American Microchemical Society, the Eastern Analytical Symposium Award in 1989 and received the A.C.S. award in Surface Chemistry (Adamson Award) at the Denver ACS meeting in April 1993. He received the Pittsburgh Spectroscopy Award at the Pittsburgh Conference in 1996. He will receive the 1997 award of the Pittsburgh Section of the ACS. He is a Guggenheim Fellow and received an Alexander von Humboldt prize.

**Post-Seminar Dinner with**
**Dr. David M. Hercules**

**Thursday, February 17, 2000**

Seminar
Chemistry Building, Rm A400
Indiana University
Bloomington, IN
6:00 p.m.

Dinner
Janko's Little Zagreb
223 West Sixth Street
Bloomington, IN
7:30 p.m.

For dinner, please RSVP Andrew Leach (issas@indiana.edu or (812) 855-7905) by February 15, 2000.

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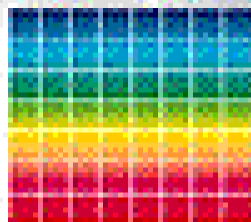

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