# 48TH ANNUAL
# DENVER X-RAY CONFERENCE
## SHERATON STEAMBOAT RESORT
## STEAMBOAT SPRINGS, COLORADO
## 2–6 AUGUST 1999

### 1999 Denver X-ray Conference Organizing Committee:

**Randolph Barton, Jr.,** DuPont Experimental Station, Wilmington, DE

**Victor E. Buhrke,** The Buhrke Company, Portola Valley, CA

**John V. Gilfrich,** SFA, Inc./NRL, Washington, DC

**George J. Havrilla,** Los Alamos National Laboratory, Los Alamos, NM

**Ting C. Huang,** Consultant/IBM, San Jose, CA

**Ron Jenkins,** Chair, International Centre for Diffraction Data, Newtown Square, PA

**Terry Maguire,** Liaison, International Centre for Diffraction Data, Newtown Square, PA

**I. Cev Noyan,** IBM, Yorktown Heights, NY

**Paul K. Predecki,** Past Chair, University of Denver, Denver, CO

**Deane K. Smith,** Emeritus, The Pennsylvania State University, University Park, PA

**Robert L. Snyder,** The Ohio State University, Columbus, OH

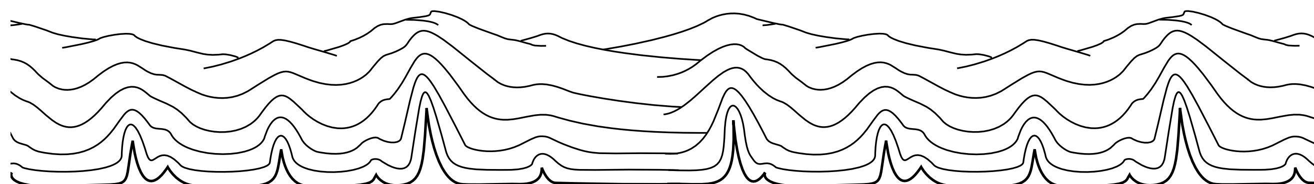
**Mary Ann Zaitz,** IBM Microelectronics, Hopewell Junction, NY

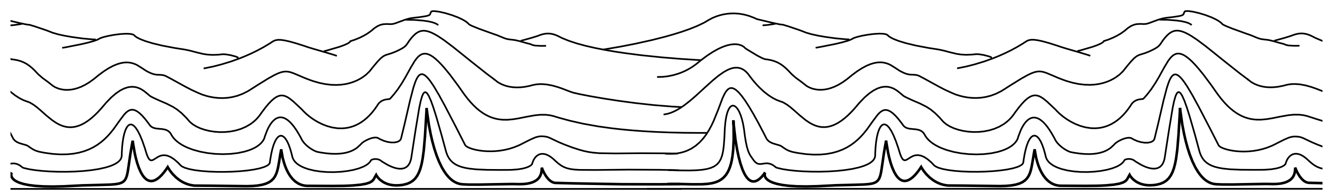
### Future Conference Dates:

July 31 – August 4, 2000: Denver Marriott Tech Center Hotel
Denver, Colorado

**Program:**

This program is also available on the Denver X-ray Conference web page at http://www.dxcicdd.com. The information contained in this program is current as of the printing date. Changes will be communicated at the conference.





# 1999 Denver X-ray Conference Program
# Table of Contents


Accommodations and Travel ....................1

Registration Information ....................2

Exhibitor Information ....................3

Evening Technical Sessions and Social Functions ....................4

General Information ....................4

Monday Workshops ....................5

Tuesday Workshops ....................7

Monday XRF Poster Session ....................9

Tuesday XRD Poster Session ....................13

Wednesday Sessions, Including Plenary ....................18

Thursday Sessions ....................24

Friday Sessions ....................35

Summer Activities in Steamboat Springs ....................39

Directions to Steamboat Springs ....................40

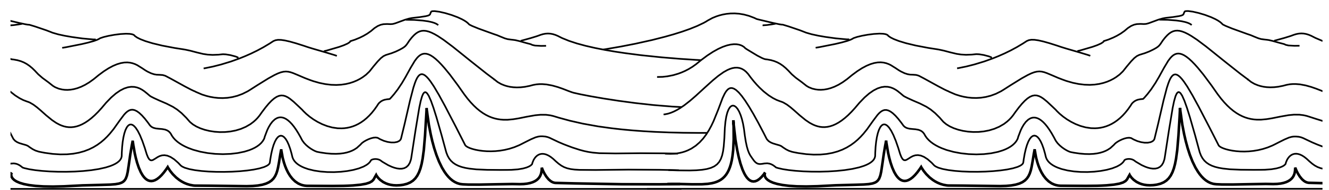
Area Maps ....................41

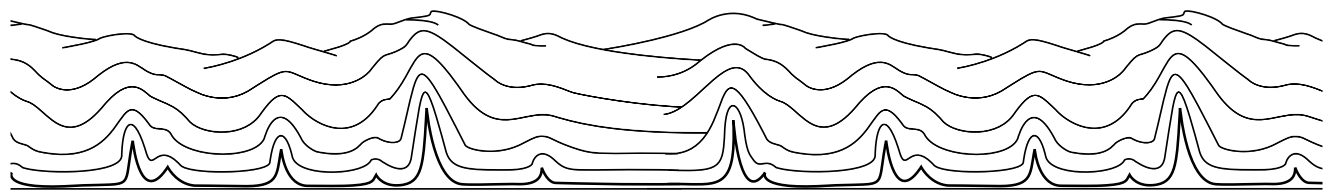
Hotel Layout ....................42

Program-At-A-Glance ....................43

Travel Form ....................45

Conference Registration Form ....................47



# Accommodations and Travel

## Hotel Accommodations:

The 1999 Denver X-ray Conference will be held 2–6 August 1999 at the Sheraton Steamboat Resort, 2200 Village Inn Court, P.O. Box 774808, Steamboat Springs, CO 80477, U.S.A., phone: 1-800-848-8878, outside the U.S. phone: 1-970-879-2220, fax: 1-970-879-7322.

## Reservation Information:

Attendees are responsible for making their own reservations. Please identify yourself as a Denver X-ray Conference attendee when booking your reservation. Reservations should be made as soon as possible since there are a limited number of rooms available at the conference rate. The special conference rate of $97 per day (plus 10.6% tax and resort fees) will only be applicable before 1 July 1999, subject to availability. Please note the hotel's policies concerning reservations:

- cancellations made less than 72 hours prior to arrival are subject to a one night's stay as originally booked unless the room is resold
- a one-night advance deposit is required within15 days of booking to guarantee your reservation
- no-show guests forfeit the one-night deposit

## Student Accommodations:

A limited number of rooms are also available for students at the Plaza Condominiums. Student rooms are $30 per bed (plus 10.6% tax and resort fees). Please contact the Conference Coordinator, Denise Flaherty (flaherty@icdd.com), for detailed information regarding student rooms.

## Travel Arrangements:

### Air Transportation:

The Denver X-ray Conference has selected Kitty Ward Travel, Inc. as the official travel agent for the conference. Kitty Ward Travel has negotiated special fares with Continental Airlines and United Airlines. A **Request for Air Travel** form is included on page 45 of this program. Please complete the form and fax to Kitty Ward Travel at Fax: 610-543-0786 or call 610-543-0680 or 800-752-3718. If you prefer to arrange your own travel, you may still take advantage of the special airfares by referring to the Denver X-ray Conference numbers when making your reservations.

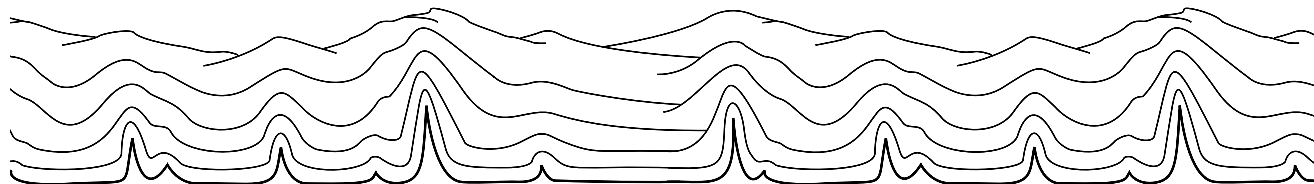
The numbers are as follows:

| | | |
|---|---|---|
| Continental Airlines | Phone: 1-800-468-7022 | DXC Reference Number: 08FJ1D |
| United Airlines | Phone: 1-800-521-4041 | DXC Reference Number: 527ZH |

### Ground Transportation:

This year, AVIS has been chosen to be our official rental car company. When calling to reserve a car, please use the following group number: J097407. You may contact AVIS at 1-800-331-1600. Directions to the Sheraton are included on page 40.

Shuttle service is also available from the Denver International Airport (DIA) and Yampa Valley Regional Airport (HDN) in Hayden. Please see page 40 for further information.



# Registration Information

## Conference Registration Fees*

*All attendees must register for the conference, including chairs, invited speakers, and instructors.*

*Discounted fees will be applied to registrations received before 14 July 1999. The reduced registration fee will only be applied if registration form and payment are received on or before 14 July 1999. Attendees may pre-register by completing the form on page 47 of this program and sending it to: Denise Flaherty, ICDD, 12 Campus Blvd., Newtown Square, PA 19073-3273, U.S.A. E-mail dxc@icdd.com ◆ phone 610-325-9814 ◆ fax 610-325-9823. Registration checks should be made payable to **ICDD/DXC** and enclosed with the registration forms.

| | By July 14th | After July 14th |
|---|---|---|
| •Full week: exhibits, workshops, sessions† | $275 | $325 |
| •Monday & Tuesday: exhibits, workshops† | $225 | $275 |
| •Wednesday, Thursday & Friday: exhibits, sessions† | $225 | $275 |
| •Invited speakers & workshop instructors† | $100 | $100 |
| •Students, unemployed X-ray people, and persons 65 and older: exhibits, workshops, sessions | $50 | $50 |
| •Conference dinner, Thursday evening | $31 | $31 |

†Includes a copy of Volume 43 of ***Advances in X-ray Analysis*** on CD-ROM

Take advantage of this opportunity to include the following orders with your conference registration fee:

- ***Advances in X-ray Analysis,*** Cumulative Volumes 1–39 on CD-ROM: $350
- ***Advances in X-ray Analysis,*** Volume 40 on CD-ROM: $150
- ***Powder Diffraction***☆ (Individual one year subscription): Domestic $60 / Overseas $85
- ***Powder Diffraction***☆ (Institution one year subscription): Worldwide $105

☆***Powder Diffraction*** is a quarterly journal that focuses on materials characterization employing X-ray powder diffraction techniques and procedures. For more information, please call 1-516-576-2200.

### On-site Registration:

All on-site registrations will be conducted at the Conference Registration Desk, located in the foyer on the ground floor of the Sheraton Steamboat Resort.

### Registration Times:

| | |
|---|---|
| Sunday, 1 August | 4:00 p.m. – 7:00 p.m |
| Monday, 2 August | 7:30 a.m. – 3:00 p.m. |
| Tuesday, 3 August | 8:00 a.m. – 3:00 p.m. |
| Wednesday, 4 August | 8:00 a.m. – 2:00 p.m. |
| Thursday, 5 August | 8:00 a.m. – 2:00 p.m. |

### Please Note:

Attendees (even those pre-registered) should check in at the Conference Registration Desk for conference materials (name tags, Book of Abstracts, etc.).

### Cancellation Policy:

All cancellation refunds will be assessed a $25 processing fee. Cancellations must be submitted in writing to the Conference Coordinator. A full refund will be issued, less processing fee, if the cancellation is received prior to Monday, 26 July 1999. No refunds will be issued for cancellations received after 26 July 1999.

# Exhibitor Information

## Exhibitor Information

Exhibits will be located in the foyer, Mt. Werner and Storm Peak rooms on the ground floor of the hotel. A diagram of the exhibit locations will be available in the Book of Abstracts.

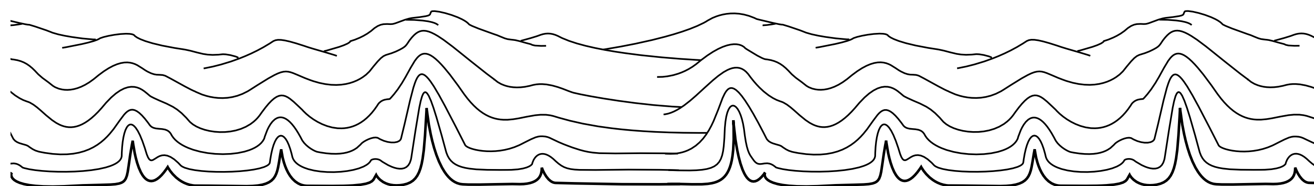
**Exhibit Hours:**

| Day | Hours |
|---|---|
| Monday | 10:00 a.m. to 5:00 p.m. |
| Tuesday | 10:00 a.m. to 5:00 p.m. |
| Wednesday | 10:00 a.m. to 5:00 p.m. |
| Thursday | 10:00 a.m. to 2:00 p.m. |

**Exhibitors as of 1 May 1999**

- AMIA Laboratories
- AMPTEK, Inc.
- Angstrom, Inc.
- ARL
- Asoma/Spectro
- ATOMIKA Instruments
- Bede Scientific, Inc.
- Blake Industries, Inc.
- Bruker AXS, Inc.
- Diffraction Technology
- INEL
- International Centre for Diffraction Data (ICDD)
- Kratos Analytical, Inc.
- LND, Inc.
- Materials Data, Inc. (MDI)
- Molecular Simulations, Inc.
- Newport Corporation
- Osmic, Inc.
- Philips Analytical
- Rigaku/USA, Inc.
- Scintag, Inc.
- Seifert X-ray Corporation
- Sietronics Group
- SPEX CertiPrep, Inc.
- Veeco Instruments, Inc.
- X-ray Instrumentation Associates
- X-ray Optical Systems, Inc.

All exhibitors are invited to attend the
**Exhibitors' General Meeting**
Wednesday, 4 August 1999, 6:00 – 6:30 p.m. in the Skyline room



## Evening Technical Sessions and Social Functions

*–Spouses are welcome to attend all social functions*

*–All Evening Mixers and Poster Sessions will be held in the* ***Sunshine Peak Room***

| | | |
|---|---|---|
| **Sun., 1 August** | 5:30 – 7:30 | **Welcoming Reception**<br>Sponsored by Bede Scientific, SPEX CertiPrep and Claisse Scientifique |
| **Mon., 2 August** | 6:30 – 8:30 | **Bruker AXS, Inc. Reception & XRF Poster Session**<br>Sponsored by Bruker AXS, Inc. |
| **Tues., 3 August** | 6:30 – 8:30 | **MDI and Rigaku/USA Reception & XRD Poster Session**<br>Sponsored by Materials Data, Inc. and Rigaku/USA |
| **Thurs., 5 August** | 7:00 | **Conference Dinner**<br>Tickets will be sold at the conference registration desk, located in the foyer on the ground floor of the Sheraton Steamboat Resort, until Wednesday at noon. Cost: $31 per ticket. |

### Spouses' Coffee Hour:

All spouses are invited to attend a complimentary coffee hour sponsored by the Denver X-ray Conference. Coffee, tea and pastries will be served in the Daybreak Room, Monday through Wednesday, from 9:30 to 10:30 a.m. Information on local attractions and activities of interest will be provided.

### General Information:

**ICDD Meetings:** A schedule of ICDD meetings will be posted at the conference.

**Book of Abstracts:** Please stop at the conference registration desk to receive your Book of Abstracts.

**Employment Clearinghouse:** We will have a separate bulletin board for this purpose. Prospective employers and employees should bring announcements with them for posting.


*Don't miss this meeting of interest in Denver*

**SPIE's International Symposium on Optical Science, Engineering, and Instrumentation**

Colorado Convention Ctr., Denver, Colorado USA

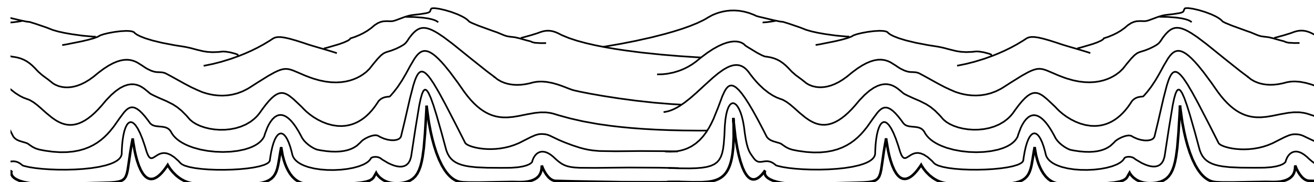
18–23 July 1999

Symposium Chair: **David Begley,** Ball Aerospace & Technologies Corp.

Over 2800 papers in 70 conferences will be presented in the following programs:

- **X-Ray Astronomy**
- **Penetrating Radiation**
- **Synchrotron Radiation Optics**
- **EUV, Soft X-Ray, and Particle Optics**
- **Detector and Imager Science and Engineering**

For more information or to request an Advance Technical Program contact: Krista Fleming at SPIE, phone 360-676-3290, fax 360-647-1445, e-mail kristaf@spie.org, or the SPIE web site: http://www.spie.org/info/annualmeeting/home.html

# Workshops

Monday, 2 August – Tuesday, 3 August

a.m. workshops: 9:00 a.m. – 12:00 noon • p.m. workshops: 2:00 p.m. – 5:00 p.m.

## Workshops, Monday a.m.

### XRD & XRF:

### W-1 Use of the Web as a Resource (Twilight)

Organized by: **M. Kottenhahn,** ICDD, Newtown Square, PA
**J. Faber,** ICDD, Newtown Square, PA

Instructors: **M. Kottenhahn,** ICDD, Newtown Square, PA
**J. Faber,** ICDD, Newtown Square, PA
**C.R. Hubbard,** Oak Ridge National Laboratories, Oak Ridge, TN

This workshop will focus on concepts of mining the web for information using search engines, search indexes, and other resources. Getting 754,710 hits when you put "X-ray" into your search engine? Find out how to extract what you want and evaluate the found information. Receive tips to ensure that **your** web page is found. Program development tools that enhance internet communications in addition to an overview of X-ray related web sites will be presented.

### XRD:

### W-2 ISO 9000 and Standards—XRD (Sunshine Peak)

Organized by: **C. Goldsmith,** IBM, Hopewell Junction, NY

Instructors: **T.N. Blanton,** Eastman Kodak Company, Rochester, NY
**J.P. Cline,** National Institute of Standards and Technology, Gaithersburg, MD

This workshop will cover the elements required of us, the end user in the X-ray laboratory, for certification under the ISO 9000 program. ISO 9000 requires calibration of the X-ray instruments, which in turn requires the purchase of certified standards for calibration. The preparation and certification of these standards will be described.

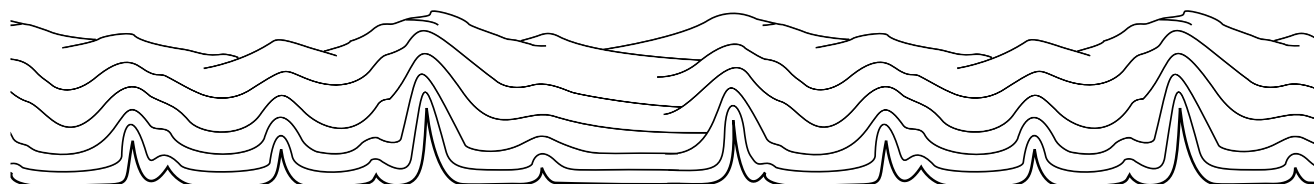
### XRF:

### W-3 How to Set up an XRF Analytical Process (Buddy's Run)

Organized by: **R. Jenkins,** ICDD, Newtown Square, PA

Instructors: **R. Jenkins,** ICDD, Newtown Square, PA
**V. Kocman,** A.S.O. Design Inc., Canada

This workshop discusses the various aspects of the design and application of routine XRF analytical processes. The various steps include specimen preparation, selection and use of calibration standards, selection and testing of quantitative algorithms, and establishment of long-term check standards.



## Workshops, Monday p.m.

### XRD:

#### W-4 Two-dimensional Detectors (Buddy's Run)

Organized by: **T.N. Blanton,** Eastman Kodak Company, Rochester, NY

Instructors: **T.N. Blanton,** Eastman Kodak Company, Rochester, NY
**U. Preckwinkel,** Bruker AXS, Inc., Madison, WI
**J. Ferrara,** Molecular Structures Corporation, The Woodlands, TX
**R. Durst,** Bruker AXS, Inc., Madison, WI

This workshop covers the use of two-dimensional detectors for X-ray diffraction applications. Four detector systems will be discussed: X-ray film, image plate, multiwire, and CCD detectors. Future directions of detectors will also be presented.

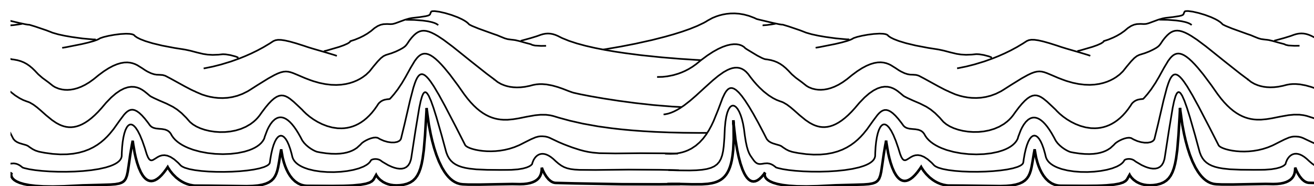
### XRF:

#### W-5 Quantitative XRF—Standardless Methods (Sunshine Peak)

Organized by: **J.A. Anzelmo,** Bruker AXS, Inc., Madison, WI

Instructors: **J.A. Anzelmo,** Bruker AXS, Inc., Madison, WI
**K.M. Mauser,** Bruker AXS GmbH, Germany
**R. Yellepeddi,** ARL, Switzerland

Two approaches have emerged as the methods of performing so-called Standardless Analysis. The two approaches are 1) scanning and 2) counting directly on peaks and backgrounds. This workshop will discuss various aspects of the two approaches such as the theory, data collection, data manipulation, calibration, sample preparation, and practical examples.



## Workshops, Tuesday a.m.

### XRD & XRF:

**W-6 Accuracy Through Optimum Calibration** (Sunshine Peak)

Organized by: **R. Jenkins,** ICDD, Newtown Square, PA
**R.L. Snyder,** The Ohio State University, Columbus, OH

Instructors: **R. Jenkins,** ICDD, Newtown Square, PA
**R.L. Snyder,** The Ohio State University, Columbus, OH
**G. Berti,** Universita' di Pisa, Italy

This workshop covers the need for correct and appropriate calibration procedures to be used in the X-ray analysis of materials. The impact of such calibration on instrument performance and data treatments will be discussed.

TUESDAY WORKSHOPS

### XRD:

**W-7 Public Domain Software** (Rainbow)

Organized by: **J. Faber,** ICDD, Newtown Square, PA
**T. Huang,** Consultant/IBM, San Jose, CA

**Description not available.**

### XRF:

**W-8 ISO 9000 and Standards—XRF** (Buddy's Run)

Organized by: **G.J. Havrilla,** Los Alamos National Laboratory, Los Alamos, NM
**M.A. Zaitz,** IBM Microelectronics, Hopewell Junction, NY

Instructors: **M.A. Zaitz,** IBM Microelectronics, Hopewell Junction, NY
**B. Benzel,** Marathon Oil Company, Littleton, CO
**J.R. Sieber,** National Institute of Standards and Technology, Gaithersburg, MD
**R.L. Watters, Jr.,** National Institute of Standards and Technology, Gaithersburg, MD

The workshop will involve discussion of quality issues in the laboratory in general, and specifics concerning the X-ray laboratory. The workshop will cover, using ISO 9000 in lab operations, what it means to meet ISO requirements, how they affect work processes and the impact they have on lab operations. There will also be mention of the ISO 14000 environmental standard. QA/QC operations in the X-ray lab will be discussed. A recent EPA audit will be reviewed and what happened as a result. This will address the impact on electronic data acquisition and the future of LIMS/electronic laboratory databases. A description of the national and international efforts to streamline the acceptance of measurements in the global marketplace will be presented. This will involve the role of SRMs and what part ISO and Baldrige criteria play in overall national data quality.

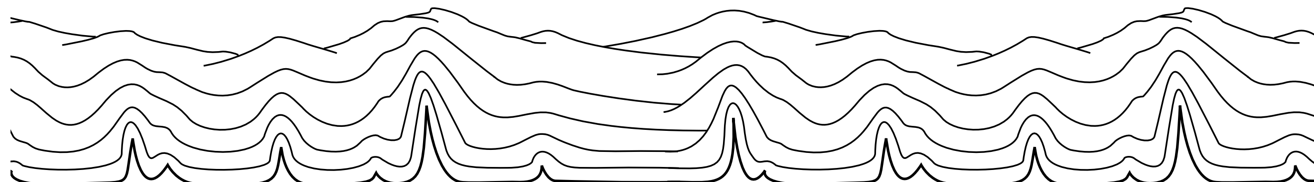
**W-9 Surface Analysis** (Twilight)

Organizers & Instructors: **H. Ebel,** Technische Universität Wien, Austria
**M.F. Ebel,** Technische Universität Wien, Austria
**C. Streli,** Atominstitut of the Austrian Universities, Austria

This workshop will focus on the need for surface analysis and will include the definition and application of surface analysis, sampling depth and lateral resolution for surface analysis, and comparison of X-ray methods with associated techniques. Techniques discussed will include:

- X-ray excited electron emission with energy dispersive electron detection (**X**-ray **P**hotoelectron **S**pectrometry: XPS or **E**lectron **S**pectroscopy for **C**hemical **A**nalysis: ESCA)
- X-ray excited emission of characteristic x-radiation combined with variation of beam geometry towards total reflection (**T**otal Reflection **X**-**r**ay **F**luorescence Analysis: TXRF)
- X-ray excited electron emission with nondispersive electron detection (**T**otal **E**lectron **Y**ield: TEY)

Selected examples of application will be discussed.



# Workshops, Tuesday p.m.

## XRD:

### W-10 Rietveld Analysis (Buddy's Run)

Organizers & Instructors: **R.A. Young,** Georgia Institute of Technology, Atlanta, GA
**D.L. Bish,** Los Alamos National Laboratory, Los Alamos, NM

This workshop provides recommendations on setting up a Rietveld refinement and getting it well started, working in more complexity until the desired detail is obtained (or determined to be unattainable), avoiding or recovering from pitfalls, exploiting the correlation matrix, using constraints, using the detailed information in a Rietveld plot, evaluating the reliability of the results, and on collecting data worth using for Rietveld refinement.

### W-11 Polymer Data Analysis (Twilight)

Organized by: **N.S. Murthy,** AlliedSignal, Inc., Research & Technology, Morristown, NJ

Instructors: **N.S. Murthy,** AlliedSignal, Inc., Research & Technology, Morristown, NJ
**J. Blackwell,** Case Western Reserve University, Cleveland, OH
**B.S. Hsiao,** State University of New York at Stony Brook, Stony Brook, NY

Techniques for analyzing wide- and small-angle X-ray diffraction data from polymers will be presented. Analysis of wide-angle X-ray diffraction data to determine the structure, crystallinity, crystal size, disorder, and the orientation of the crystalline and amorphous domains will be discussed. Analysis of the long-range order in semicrystalline polymers will be illustrated using the correlation function analysis of the small-angle X-ray scattering data obtained during melting and crystallization of semicrystalline polymers.

## XRF:

### W-12 Computational Methods for XRF (Rainbow)

Organizers & Instructors: **G. Lachance,** Emeritus, Geological Survey of Canada, Canada
**J. Criss,** Criss Software, Largo, MD

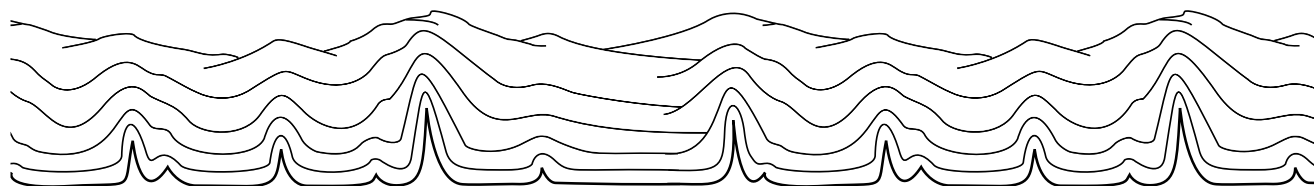
A tutorial workshop that examines in detail the basic principles underlying computational methods in XRF analysis. The topic is addressed from the point of view of someone who is relatively new to this technique. The first half covers common mathematical expressions presently in use by analysts while the second half deals with methods, i.e., how these expressions are used in practice. Ample time is allocated for questions and discussion.

### W-13 Specimen Preparation—XRF (Sunshine Peak)

Organized by: **V.E. Buhrke**, The Buhrke Company, Portola Valley, CA

Instructors: **V. Kocman,** A.S.O. Design Inc., Canada
**N. Dando,** ALCOA, Alcoa Technical Center, PA
**D. Broton,** Construction Technology Laboratories, Skokie, IL

Speakers' talks will contain an eclectic mixture of practical information useful to beginners and experienced spectroscopists. Handouts will be available to attendees. There will be a discussion of the minimum specimen preparation equipment required, a discussion and sketch of a lab layout, plus a brief outline of some of the analysis procedures. Speakers' discussions will, in some cases, also include photos of good and bad specimens. Recommendations will be made on paperwork useful to follow a sample from receipt in the lab to the report of the analysis. If time permits, there will be some discussion about ISO 9000 or A2LA.



Sessions
Poster Sessions: Monday, 2 August – Tuesday, 3 August
Oral Sessions: Wednesday, 4 August – Friday, 6 August

## XRF Poster Session, Monday, 2 August (Sunshine Peak)

(6:30 p.m. – 8:30 p.m., authors present)

*The XRF Poster Session will be held in conjunction with the Bruker AXS, Inc. mixer.*

Chairs: **G.J. Havrilla,** Los Alamos National Laboratory, Los Alamos, NM
**H. Ebel,** Technische Universität Wien, Austria

*Session chairs will select the three best papers for awards.*

### Combined XRF and XRD Instrumentation:

C-5 APPLICATIONS OF SCANNING INSTRUMENTS BY MEANS OF MICRO-XRF, XRD AND XRT
**Y. Hosokawa,** Horiba, Ltd., Japan
**R. Wong,** KevexSpectrace, Sunnyvale, CA

C-2 DATA COLLECTION STRATEGIES USING ENERGY-DISCRIMINATING CCD DETECTORS FOR SIMULTANEOUS XRD/XRF ANALYSES
**S.J. Chipera, D. Bish, D. Vaniman,** Los Alamos National Laboratory, Los Alamos, NM
**P. Sarrazin, D. Blake,** NASA Ames Research Center, Moffett Field, CA

C-1 IDENTIFICATION OF CuCl IN Si BY XRD–XRF ANALYSIS
**C.-T. Li, L. Tarhay,** Dow Corning Corporation, Midland, MI

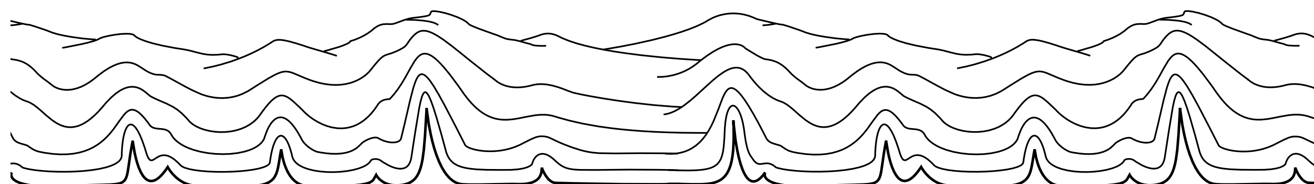
C-4 ENERGY RESOLVED X-RAY DETECTION USING CHARGE-COUPLED DEVICES
**A. Reyes-Mena, H.K. Pew, P. Moody,** MOXTEK, Inc., Orem, UT
**L.V. Knight, S. Cornaby, A. Stradling, E. Wilcox,** BYU

### X-ray Optics:

F-55 X-RAY FLUORESCENCE USING A FOCUSING CRYSTAL SPECTROMETER
**L. Knight,** Brigham Young University, Provo, UT
**S. Voronov,** MOXTEK, Inc., Orem, UT
**A. Shevelko, P.N. Lebedev,** Physical Institute of the Russian Academy of Sciences, Russia

F-54 POLYCAPILLARY X-RAY OPTICS FOR X-RAY ASTRONOMY
**C.H. Russell,** National Institute of Standards and Technology, Gaithersburg, MD
**M. Gubarev, J. Kolodziejczak, M. Joy,** NASA, Huntsville, AL
**C.A. MacDonald, W.M. Gibson,** University at Albany, SUNY, Albany, NY

F-19 APPLICATIONS OF POLYCAPILLARY OPTICS IN MICRO X-RAY FLUORESCENCE (MXRF) METROLOGY SYSTEM
**W. Si, F. Ferrandino,** Veeco Instruments, Inc., Ronkonkoma, NY



## Environmental Applications:

F-35 INFLUENCE PHYSICAL FACTORS ON THE STRENGTH MERCURY, ARSENIC AND BISMUTH HUMATE COMPLEXES USED FOR X-RAY FLUORESCENCE ANALYSIS OF NATURAL WATER
**L.P. Eksperiandova, Y.N. Makarovska, A.B. Blank, V.B. Naumenko,** Institute for Single Crystals, Ukraine

D-102 X-RAY EMISSION ANALYSIS OF ATMOSPHERE PARTICLES OF THERAPEUTIC CAVES
**S. Török, B. Alföldy, I. Balásházy,** KFKI Atomic Energy Research Institute, Hungary
**I. Balla,** Astra Clinical Research Unit, Hungary

## TXRF:

F-33 TXRF ANALYSIS OF THIN METALLIC FILMS
**A.R. Ghatak-Roy, T.Z. Hossain,** Advanced Micro Devices, Inc., Austin, TX

F-08 THE MODIFICATION OF TXRF-METHOD BY USE OF X-RAY SLINLESS COLLIMATOR
**V.K. Egorov, A.P. Zuev, O.S. Kondratiev,** Institute Problems Microelectronic Technology RAS, Russia
**E.V. Egorov,** Moscow Engineering Physical Institute, Russia

## XRF Instrumentation and Techniques:

F-37 THE INFLUENCE OF SPECIMEN SIZE AND BEAM DIVERGENCES ON QUANTITATIVE XRF BY FUNDAMENTAL PARAMETER METHODS
**M. Mantler, B. Hochleitner,** Vienna University of Technology, Austria

F-17 IMPROVEMENT OF THE QUANTIFICATION PROCEDURE FOR MERCURY DETERMINATION IN QUARTZ FILTER
**S. Kurunczi, S. Török,** KFKI Atomic Energy Research Institute, Hungary
**J.W. Beal,** Fairfield University, Fairfield, CT

F-46 AN IMPROVED AEROSOL GENERATION SYSTEM TO PREPARE AEROSOL LOADED FILTERS FOR XRF CALIBRATION
**C. Vanhoof, N. De Brucker,** Flemish Institute for Technological Research, Belgium

F-56 NON DESTRUCTIVE CHARACTERIZATION OF CELTIC-GLASSES BY EDXRF
**P. Wobrauschek, G. Halmetschlager, S. Zamini, C. Jokubonis,** Atominstitut der Österreichischen Universitäten, Austria
**G. Trnka, M. Karwowski,** Institut für Ur-und Frühgeschichte Universität Wien, Austria

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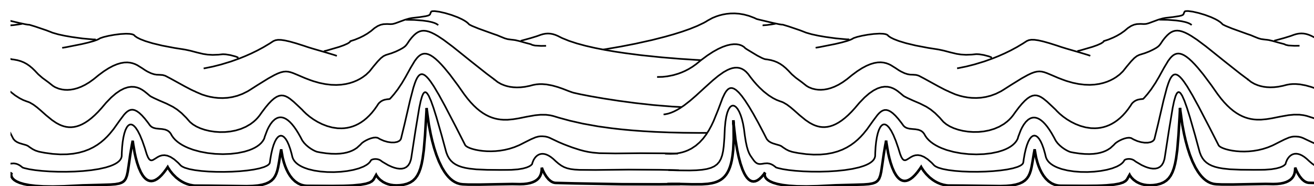


**XRF Instrumentation and Techniques:** (continued)

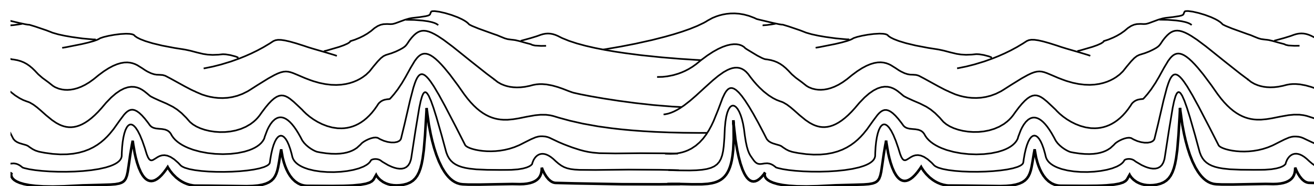
F-53 INVESTIGATION OF ELECTRON EXCITED X-RAY SPECTRA IN DEPENDENCE ON THE ANGLE OF ELECTRON INCIDENCE
**W. Dietrich, A. Dohr, C. Paul, R. Pelzer, M. Sander, M. Urschler, R. Svagera, J. Wernisch, H. Ebel,** Technische Universität Wien, Austria

F-50 NEW CONCEPTS IN XRF: HIGHER PERFORMANCE AT LOWER POWER
**K. Mauser, S. Uhlig,** Bruker AXS GmbH, Germany

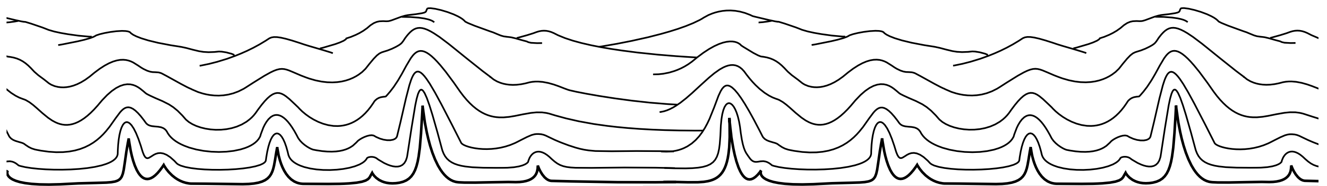
F-27 A COMPACT, LOW POWER TUBE WITH A FIELD EMISSION CATHODE
**H.K. Pew, A. Reyes-Mena, A. Astle,** MOXTEK, Inc., Orem, UT

F-40 CERTIFICATION OF STANDARD REFERENCE MATERIALS FOR CEMENTS
**J.R. Sieber, A.F. Marlow, B.S. MacDonald, S.D. Leigh,** National Institute of Standards and Technology, Gaithersburg, MD
**D. Broton,** Construction Technology Laboratories, Skokie, IL

F-29 TURNKEY APPLICATIONS SOLUTIONS FOR THE 21st CENTURY: THE USE OF XRF APPLICATIONS PACKAGES TO AID IN THE SET UP AND CONTROL OF QUANTITATIVE XRF ANALYSIS
**H. Kohno, M. Funahashi,** Rigaku Industrial Corporation, Japan



# Notes



## XRD Poster Session, Tuesday, 3 August (Sunshine Peak)

(6:30 p.m. - 8:30 p.m., authors present)

*The XRD Poster Session will be held in conjunction with the MDI and Rigaku/USA mixer.*

Chairs: **P.K. Predecki,** University of Denver, Denver, CO
**R.L. Snyder,** The Ohio State University, Columbus, OH

*Session chairs will select the three best papers for awards.*



### High Temperature and Nonambient Applications:

D-094 HIGH TEMPERATURE NEUTRON POWDER DIFFRACTION STUDY OF $Mo_5SiB_2$ and $MoSi_2$
**C.J. Rawn, C.M. Hoffmann, C.R. Hubbard, J.H. Schneibel,** Oak Ridge National Laboratory, Oak Ridge, TN

D-062 INTERNAL STANDARDS IN HIGH TEMPERATURE XRD
**M. Mantler, G. Hammerschmid,** Vienna University of Technology, Austria

D-009 IN-SITU STUDIES OF THE FORMATION AND STABILITY OF THE NEGATIVE THERMAL EXPANSION MATERIAL CUBIC $ZrMo_2O_8$
**C. Lind, A.P. Wilkinson,** Georgia Institute of Technology, Atlanta, GA
**E.A. Payzant, W.D. Porter, C. Rawn,** Oak Ridge National Laboratory, Oak Ridge, TN

D-022 VARIABLE TEMPERATURE POWDER X-RAY DIFFRACTOMETRY USING A SCINTAG LOW-HIGH TEMPERATURE STAGE: VARIATIONS IN SAMPLE HEIGHT DUE TO THERMAL EXPANSION
**C. Lind, A.P. Wilkinson,** Georgia Institute of Technology, Atlanta, GA

D-093 ANALYSIS OF POSITION, PROFILE AND INTENSITY ERRORS IN A LINEAR PSD BASED HTXRD SYSTEM
**E.A. Payzant,** Oak Ridge National Laboratory, Oak Ridge, TN

D-021 CHARACTERIZATION OF PHASE TRANSITIONS DURING FREEZE-DRYING OF CEFAZOLIN SODIUM
**A. Pyne, R. Suryanarayanan,** University of Minnesota, Minneapolis, MN

### Instrumentation:

D-053 PARALLEL BEAM POLYCAPILLARY OPTICS: AN ENABLING TECHNOLOGY FOR PLANETARY EXPLORATION
**J.B. Ullrich,** X-ray Optical Systems, Inc., Albany, NY

D-103 LOW POWER POLYCAPILLARY BASED SYSTEM FOR X-RAY PROTEIN CRYSTALLOGRAPHY
**F.A. Hofmann, W.M. Gibson, C.A. MacDonald,** University at Albany, SUNY, Albany, NY
**D.A. Carter, J.X. Ho, J.R. Ruble,** New Century Pharmaceuticals, Inc., Huntsville, AL

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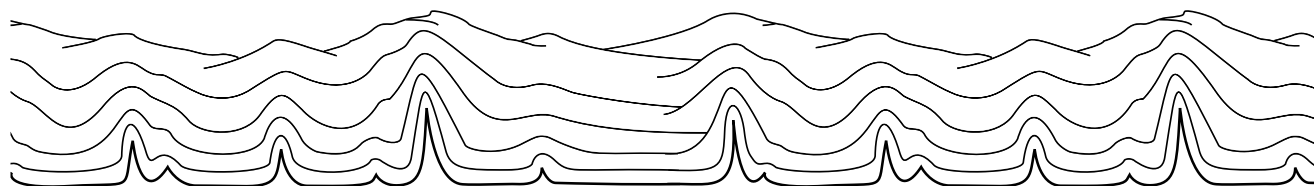

**Instrumentation:** (continued)

D-013 NARROW ROCKING CURVE MULTILAYER X-RAY MIRRORS
**S. Owens, R.D. Deslattes,** National Institute of Standards and Technology, Gaithersburg, MD
**J. Pedulla,** J. Pedulla & Associates, Silver Spring, MD

D-012 REALIZATION OF AN ASYMMETRIC MULTILAYER X-RAY MIRROR
**S. Owens, R.D. Deslattes,** National Institute of Standards and Technology, Gaithersburg, MD
**J. Pedulla,** J. Pedulla & Associates, Silver Spring, MD

D-027 TUNABLE MULTILAYER-MIRROR OPTICS FOR TABLE-TOP X-RAY MICROTOMOGRAPHY
**N. Gurker, R. Nell,** Vienna University of Technology, Austria
**W. Backfrieder,** University of Vienna, Austria

D-099 NANOSTAR: A SCANNING SMALL ANGLE X-RAY SCATTERING SYSTEM
**K.L. Smith,** Bruker Analytical X-ray Systems, Inc., Madison, WI
**H.F. Jakob,** Bruker AXS GmbH, Germany

D-058 AN INNOVATION IN TRANSMISSION COEFFICIENT MEASUREMENT
**B.B. He, K.L. Smith,** Bruker Analytical X-ray Systems, Inc., Madison, WI

D-064 A NEW SIMULTANEOUS MEASURING INSTRUMENT FOR XRD AND DSC, AND ITS APPLICATION TO PHARMACEUTICAL ANALYSIS
**A. Kishi, T. Arii, Y. Kobayashi, Y. Yamada, M. Nakayama, S. Munekawa,** Rigaku Corporation, Japan

**Stress Determination, Texture:**

D-082 NEUTRON STRESS MEASUREMENT USING NEUTRON IMAGING PLATE
**T. Sasaki, Y. Hirose,** Kanazawa University, Japan
**N. Minagawa, Y. Morii, N. Niimura,** Japan Atomic Energy Research Institute, Japan

D-113 DEFORMATION BEHAVIOR OF TWO-PHASE COMPOSITES MATERIAL USING MICROMECHANICS MODEL
**Y. Shirasuna,** Seisen Jogakuin College, Japan
**Y. Hirose,** Kanazawa University, Japan

D-005 INFLUENCE OF REHEATING TEMPERATURE ON RESIDUAL STRESS IN NITRIDED HOT WORK DIE STEEL (H13)
**K. Yatsushiro, M. Hihara,** Yamanashi Industrial Technology Center, Japan
**M. Kuramoto,** Polytechnic University, Japan

D-078 X-RAY STRESS MEASUREMENT OF Al-Si-X P/M ALLOYS USING RAPIDLY SOLIDIFIED POWDERS
**T. Saito, T. Sasaki, Y. Hirose,** Kanazawa University, Japan

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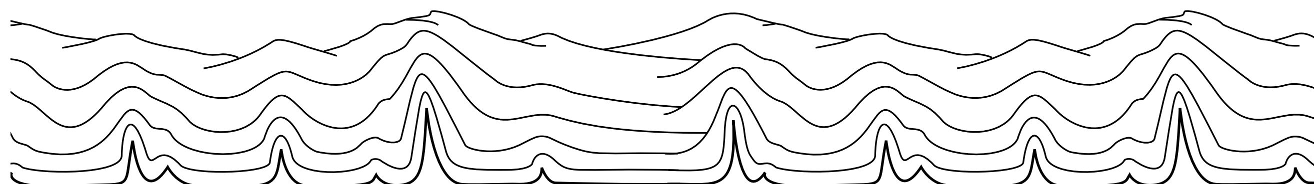

**Stress Determination, Texture:** (continued)

D-080 X-RAY STRESS MEASUREMENT FOR TITANIUM ALUMINIDE INTERMETALLIC COMPOUND
**T. Kondoh,** Aichi Institute of Technology, Japan
**T. Goto, T. Sasaki, Y. Hirose,** Kanazawa University, Japan

D-112 STUDY ON X-RAY STRESS MEASUREMENT Ni-Al SYSTEM INTERMETALLIC COMPOUND
**Y. Hirose, Y. Shirasuna, T. Goto,** Kanazawa University, Japan

D-084 X-RAY MEASUREMENT OF TRIAXIAL RESIDUAL MACRO- AND MICROSTRESS IN Fe-Cr STEEL/TiN SYSTEM COMPOSITE MATERIALS PREPARED BY POWDER METALLURGY
**S. Takago, T. Sasaki, Y. Hirose,** Kanazawa University, Japan
**M. Miyano,** RIKEN Corporation, Japan

D-079 THE RESEARCH OF FATIGUE FRACTURE MECHANISM OF SHOT-PEENED MATERIAL
**S. Takahashi, Y. Hirose,** Kanazawa University, Japan
**M. Hashimoto,** Sumitomo Heavy Industries, Japan

D-088 STUDY ON THE FATIGUE FRACTURE SURFACE REGION OF STEELS BY MICROBEAM SYNCHROTRON X-RAY DIFFRACTION
**Y. Yoshioka,** Musashi Institute of Technology, Japan
**K. Akita, H. Suzuki,** Tokyo Metropolitan University, Japan
**T. Sasaki,** Kanazawa University, Japan

D-037 DEFORMATION BEHAVIOR OF DUAL PHASE STAINLESS STEEL
**H. Hirose,** Kinjo College, Japan
**T. Sasaki,** Kanazawa University, Japan

D-114 X-RAY STRESS MEASUREMENT OF COMPOSITE PLATING (Ni-Co-P/$\alpha$-$Si_3N_4$)
**H. Masuda, S. Takago, T. Sasaki, Y. Hirose,** Kanazawa University, Japan

D-046 MEASUREMENT AND ANALYSIS OF RESIDUAL STRESS IN IRON NITRIDE ($Fe_3N$) LAYERS AS A FUNCTION OF DEPTH
**T.R. Watkins,** Oak Ridge National Laboratory, Oak Ridge, TN
**R.D. England, C. Klepser,** Cummins Engine Company, Columbus, IN
**N. Jarayaman,** University of Cincinnati, Cincinnati, OH

D-111 DEPTH PROFILING RESIDUAL STRESSES IN THIN TUNGSTEN FILMS
**T. Ely, P.K. Predecki,** University of Denver, Denver, CO
**I.C. Noyan,** IBM, Yorktown Heights, NY

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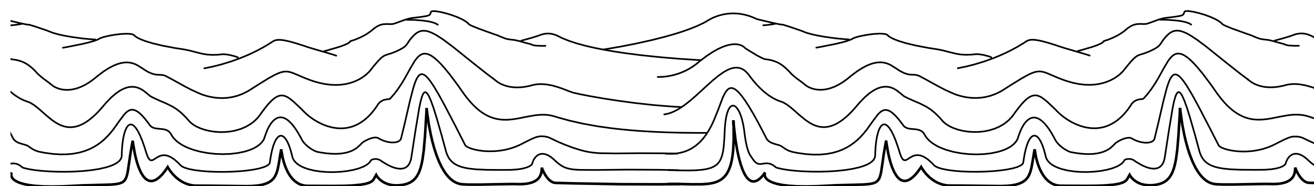

**Stress Determination, Texture:** (continued)

D-081 SIMULTANEOUS MEASUREMENT OF PLURAL POLE FIGURES USING IMAGING PLATE
**T. Goto, T. Sasaki,** Kanazawa University, Japan
**H. Hirose,** Kinjyo College, Japan

**Structure Characterization, Quantitative Phase Analysis:**

D-107 X-RAY POWDER DIFFRACTION FROM BIOLOGICAL MACROMOLECULES
**F.J. Rotella, N.E.C. Duke,** Argonne National Laboratory, Argonne, IL
**J.A. Kaduk,** BP-Amoco Research, Naperville, IL

D-002 SKIP (SMALL CRYSTAL INTERFERENCE PROGRAM): AN IMPROVED ALGORITHM FOR THE COMPUTATION OF X-RAY POWDER DIFFRACTION PATTERNS
**J.L. Schlenker, B.K. Peterson,** Mobil Technology Company, Paulsboro, NJ

D-032 POWDER X-RAY STUDY OF $Sr_2RGaCu_2O_7$ (R= Pr, Nd, Sm, Eu, Gd, Dy, Ho, Er, Tm, Yb AND Y) BY RIETVELD REFINEMENT TECHNIQUE
**W. Wong-Ng,** National Institute of Standards and Technology, Gaithersburg, MD
**J.A. Kaduk,** Amoco Corp., Naperville, IL
**W. Greenwood, J. Dillingham,** University of Maryland, Gaithersburg, MD

D-043 GLIDE TWINNING OF CHALCOPYRITE-TYPE $AgGaS_2$: MORPHOLOGY AND FORMATION MECHANISM
**H.E. Kitahara,** National Research Institute for Metals, Japan
**N. Ishizawa,** Tokyo Institute of Technology, Japan
**Y. Noda,** Shimane University, Japan

D-083 CHARACTERIZATION OF LOCAL LAYER STRUCTURE IN A SURFACE STABILIZED FERROELECTRIC LIQUID CRYSTAL USING SYNCHROTRON X-RAY MICRO-DIFFRACTION
**A. Iida,** Photon Factory, Japan
**T. Noma, H. Miyata,** Canon Research Center, Japan

D-035 QUANTIFICATION OF FLY ASH MAGNETIC SEPARATIONS
**S.L. Lerach, R.S. Winburn, G.J. McCarthy,** North Dakota State University, Fargo, ND
**J.D. Cathcart,** U.S. Geological Survey, Denver, CO

D-097 QUANTITATIVE PHASE ANALYSIS OF RAW MATERIALS, CEMENTITIOUS MATERIALS AND MULTICOMPONENT ALLOYS
**A.A. Brovkin, A.Y. Boyko, M.I. Ermolova, B.N. Kodess, I.L. Kommel, V.K. Ovcharov, A.Y. Gadayev,** VNIIMS, Russia; ICS&E, Denver, CO

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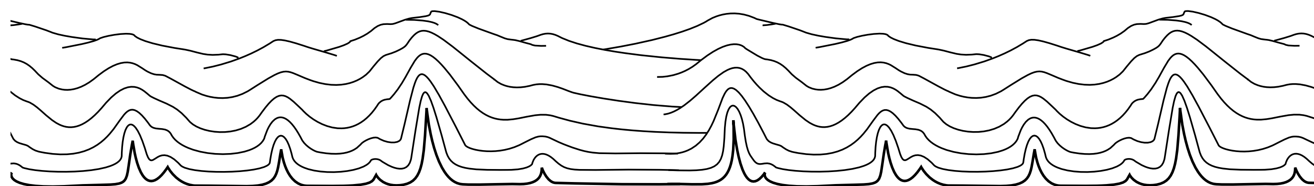


**Structure Characterization, Quantitative Phase Analysis:** (continued)

D-118 USE OF XRD FOR THE QUANTITATION OF CRYSTALLINITY IN SUBSTANTIALLY AMORPHOUS PHARMACEUTICALS
**R. Surana, R. Suryanarayanan,** University of Minnesota, Minneapolis, MN

D-126 IMPROVING THE METALS & ALLOYS SUBFILE OF ICDD'S POWDER DIFFRACTION FILE
**P.L. Wallace,** Dos Arroyos Enterprises, Marina, CA
**J.N. Dann,** OSRAM SYLVANIA Products, Inc., Towanda, PA
**H. Jones,** Pratt & Whitney, West Palm Beach, FL
**W.E. Mayo,** Rutgers University, Piscataway, NJ
**A.C. Roberts,** Geological Survey of Canada, Canada

**Thin Films:**

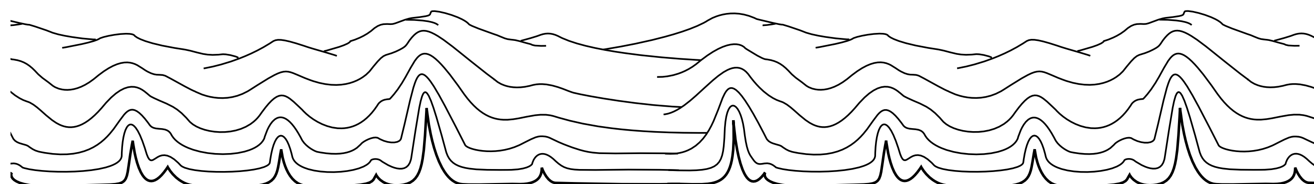
D-018 HIGH-RESOLUTION X-RAY DIFFRACTION (HRXRD) AND SIMULATION STUDY OF STRAIN-COMPENSATED 1.55 μm DFB LASER STRUCTURES REGARDING HIGH NUMBERS OF QUANTUM WELLS
**W. Görtz, S. Jochum, E. Kuphal, S. Hansmann,** Deutsche Telekom AG, Germany

D-006 APPLICATION OF GENETIC ALGORITHM TO THE REFINEMENT OF STRUCTURE PARAMETERS FROM X-RAY REFLECTIVITY DATA: SUPERLATTICES AND THIN SOLID FILMS
**A. Ulyanenkov, J. Harada,** Rigaku Corporation, Japan

D-070 ULTRATHIN FILM REFERENCE SAMPLES PRODUCED BY DUAL ION BEAM ASSISTED DEPOSITION AND CHARACTERIZED BY GRAZING INCIDENCE X-RAY SCATTERING
**J. Pedulla,** J. Pedulla Associates, Silver Spring, MD
**S.M. Owens, R.D. Deslattes,** National Institute of Standards and Technology, Gaithersburg, MD

D-029 X-RAY POWDER DIFFRACTION (XRPD) AND SCANNING ELECTRON MICROSCOPY (SEM) STUDY OF ORIENTED ANTIMONY AND BISMUTH THIN FILMS DEPOSITED VIA ORGANOMETALLIC CHEMICAL VAPOR DEPOSITION (OMCVD)
**M.P. Remington, Jr., D.G. Grier, R.S. Winburn, P. Boudjouk, G.J. McCarthy,** North Dakota State University, Fargo, ND

D-068 GRAZING INCIDENCE X-RAY DIFFRACTION CHARACTERISATION OF CORROSION DEPOSITS INDUCED BY CARBON DIOXIDE ON MILD STEEL
**S. Sembiring, B. O'Connor, D. Li, A. van Riessen, R. De Marco,** Curtin University of Technology, Perth, Australia



## Plenary Session
## Wednesday, 4 August
## Upper Gondola Terminal (take gondola from outside hotel to upper gondola terminal)

# X-rays in Space

8:30 a.m. – 12:00 noon

Organized by: **Victor E. Buhrke,** The Buhrke Company, Portola Valley, CA
**Randolph Barton, Jr.,** DuPont Experimental Station, Wilmington, DE

8:30 ◆Welcoming Remarks – **Ron Jenkins,** Chairman, Denver X-ray Conference, ICDD, Newtown Square, PA

◆Presentation of Awards

1999 Barrett Award to **Howard F. McMurdie,** National Institute of Standards and Technology, Gaithersburg, MD

*Presented by:* **Camden R. Hubbard,** Oak Ridge National Laboratories, Oak Ridge, TN

◆Plenary Session Remarks – **Victor E. Buhrke,** The Buhrke Company, Portola Valley, CA
**Randolph Barton, Jr.,** DuPont Experimental Station, Wilmington, DE

*The following are invited papers:*

9:00 P-1 THE ORIGIN OF X-RAYS IN SPACE
**H. Gursky,** Naval Research Laboratory, Washington, DC

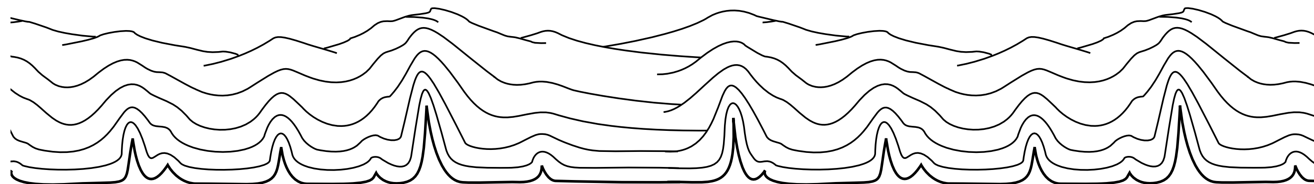
9:40 P-2 REMOTE X-RAY DIFFRACTION AND X-RAY FLUORESCENCE ANALYSIS ON PLANETARY SURFACES
**D.F. Blake,** NASA Ames Research Center, Moffett Field, CA

10:20 Break

10:40 P-3 THE INTERNATIONAL SPACE STATION X-RAY CRYSTALLOGRAPHY FACILITY
**L.J. DeLucas,** University of Alabama–Birmingham, Birmingham, AL

11:20 P-4 RECENT PROGRESS IN HIGH-RESOLUTION X-RAY SPECTROSCOPY OF ASTROPHYSICAL SOURCES
**S.M. Kahn,** Columbia University, New York, NY





## XRD & XRF

### Session C-1 GRAZING BEAM X-RAY ANALYSIS

Organized by: **R.L. Snyder,** The Ohio State University, Columbus, OH
**T.C. Huang,** Consultant/IBM, San Jose, CA

1:30 A NOVEL METHOD OF AUTOMATED FITTING OF X-RAY SCATTERING DATA — *Invited*
**M. Wormington,** Bede Scientific, Inc., Englewood, CO

2:00 D-004 X-RAY SCATTERING FROM Si SURFACES AND THIN OXIDES ON Si SUBSTRATES — *Invited*
**R. Stömmer,** Bruker AXS GmbH, Germany

2:30 F-52 ROLE OF UNCERTAINTIES AND SURFACE ROUGHNESS ON GRAZING INCIDENCE X-RAY PHOTOELECTRON SPECTROSCOPY
**E. Landree, T. Jach,** National Institute of Standards and Technology, Gaithersburg, MD

2:50 Break

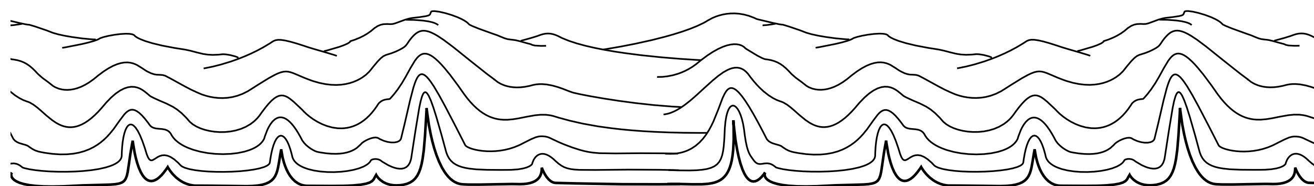
3:20 D-101 APPLICATION OF Ni/C GÖBEL MIRRORS AS PARALLEL BEAM X-RAY OPTICS FOR CuKα AND MoKα RADIATION
**T. Holz, R. Dietsch, H. Mai,** FhG-IWS, Germany

3:40 D-007 EVALUATION OF THE INTERFACE MORPHOLOGY IN Mo/Si SUPERLATTICES BY X-RAY SPECULAR AND DIFFUSE SCATTERING
**A. Ulyanenkov, R. Matsuo, K. Omote, J. Harada,** Rigaku Corporation, Japan
**M. Ishino, M. Nishii, O. Yoda,** Advanced Photon Research Center, Kansai Research Establishment, Japan

4:00 D-077 GRAZING INCIDENCE IN-PLANE DIFFRACTOMETER FOR ANALYZING SURFACES AND THIN-FILMS
**K. Omote, K. Inaba, R. Matsuo,** Rigaku Corporation, Japan
**S.Y. Matsuno,** Asahi Chemical Industry Co. LTD, Japan

4:20 D-076 X-RAY DIFFRACTION STUDIES OF MnAs FERROMAGNETIC THIN FILMS GROWN ON Si(111) SUBSTRATES
**K. Inaba, J. Harada, K. Omote,** Rigaku Corporation, Japan
**A.G. Banshchikov, N.S. Sokolov,** A.F. Ioffe Physical Technical Institute of RAS, Russia





## XRD & XRF

**Session C-2 TOPOGRAPHY & ABSORPTION ANALYSIS — 1/4 day**

Organized by: **S.R. Stock,** Georgia Institute of Technology, Atlanta, GA
**M.F. Ebel,** Technische Universität Wien, Austria

1:30 F-16 QUANTITATIVE ABSORPTIOMETRY BY TOTAL ELECTRON YIELD (TEY) — *Invited*
**H. Ebel,** Technische Universität Wien, Austria

2:00 D-110 X-RAY MICROBEAMS AND THREE-DIMENSIONAL MICROTEXTURE MAPPING — *Invited*
**S.R. Stock,** Georgia Institute of Technology, Atlanta, GA

2:30 D-075 TOPOGRAPHIC OBSERVATIONS OF POLYCRYSTALLINE ALUMINUM BY MEANS OF SCANNING WITH MICRO-XRD
**Y. Hosokawa,** Horiba, Ltd., Japan
**Y. Miyoshi,** The University of Shiga Pre., Japan

2:50 Break

## XRD:

**Session D-1 APPLICATIONS OF DIFFRACTION TO PHARMACEUTICAL ANALYSIS — 1/4 day**

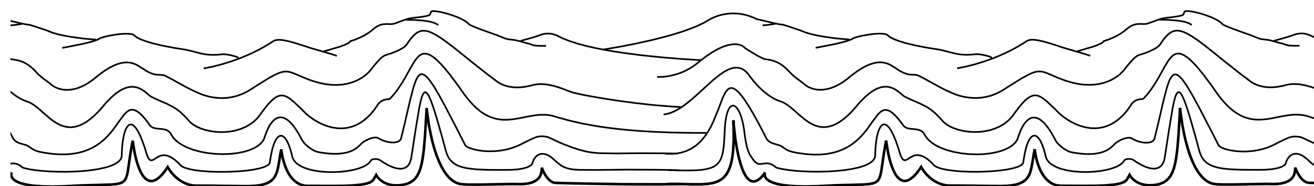
Organized by: **D.F. Rendle,** The Metropolitan Police Forensic Science Lab, UK
**G.A. Stephenson,** Eli Lilly & Company, Indianapolis, IN

3:10 D-117 EXAMINATION OF PHASE TRANSFORMATIONS DURING FREEZE-DRYING USING LOW TEMPERATURE X-RAY POWDER DIFFRACTION — *Invited*
**R.G. Suryanarayanan,** University of Minnesota, Minneapolis, MN

3:40 X-RAY DIFFRACTION STUDIES OF ISOSTRUCTURAL PHARMACEUTICAL SYSTEMS — *Invited*
**G.A. Stephenson,** Eli Lilly & Company, Indianapolis, IN

4:10 APPLICATIONS OF SYNCHROTRON RADIATION TO PROBLEMS IN PHARMACEUTICAL SCIENCES — *Invited*
**P.W. Stephens,** State University of New York at Stony Brook, Stony Brook, NY

4:40 D-001 CRYSTAL AND MOLECULAR STRUCTURES OF C-NITRO HETEROCYCLES FROM LABORATORY POWDER DIFFRACTION DATA
**V.V. Chernyshev,** Moscow State University, Russia
**A.N. Fitch,** ESRF, France
**E.J. Sonneveld,** University of Amsterdam, The Netherlands
**V.A. Makarov,** State Scientific Center “NIOPIK”, Russia



## XRD:

## Session D-2 RIETVELD APPLICATIONS I

Organized by: **D.L. Bish,** Los Alamos National Laboratory, Los Alamos, NM
**D.K. Smith,** Emeritus, The Pennsylvania State University, University Park, PA

2:00 D-104 APPLICATION OF RIETVELD REFINEMENT TO ENGINEERING STRAIN-RELATED PROBLEMS — *Invited*
**M.A.M. Bourke,** Los Alamos National Laboratory, Los Alamos, NM

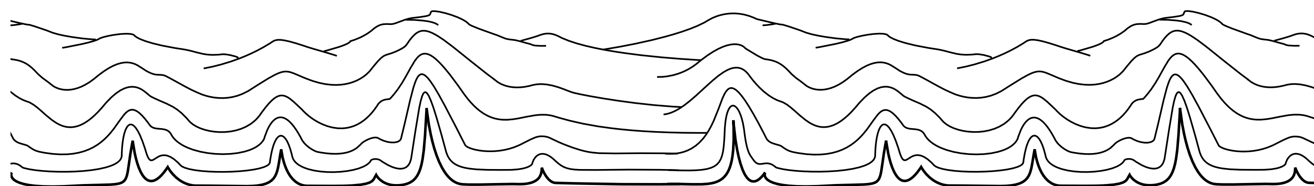
2:30 D-092 AB INITIO STRUCTURE SOLUTION AS PART OF THE RIETVELD REFINEMENT PROCESS
**A. Kern, A. Coelho,** Bruker AXS GmbH, Germany
**P.J. LaPuma,** Bruker AXS, Inc., Madison, WI

2:50 Break

3:20 D-048 RIETVELD SIMULATIONS OF COMPLEX Y-PSZ MIXTURES
**J.R. Verkouteren, J.M. Conny,** National Institute of Standards and Technology, Gaithersburg, MD

3:40 D-033 CRYSTALLOGRAPHIC STUDIES OF THE $SrR_2CuO_5$ SERIES (R= LANTHANIDES) WITH RIETVELD REFINEMENTS
**W. Wong-Ng, T. Haugan,** National Institute of Standards and Technology, Gaithersburg, MD
**J. Dillingham,** University of Maryland, Gaithersburg, MD
**R.A. Young,** Georgia Institute of Technology, Atlanta, GA

4:00 D-014 EVOLUTION OF ATOMIC STRUCTURE IN SOME FERROELECTRIC COMPLEX METAL OXIDES
**S. Ivanov,** Karpov' Institute of Physical Chemistry, Russia
**R. Tellgren, H. Rundlöf,** Uppsala University, Sweden
**S.-G. Eriksson,** University of Gothenburg, Sweden



**XRD:**

**Session D-3 POLYMERS I: DIFFRACTION STUDIES OF INDUSTRIAL POLYMER-BASED MATERIALS PLATFORMS**

Organized by: **K.B. Schwartz,** Raychem Corporation, Menlo Park, CA
**T.N. Blanton,** Eastman Kodak Company, Rochester, NY

2:00 D-026 IN-SITU STUDIES OF POLYMER PROCESSING, CRYSTALLIZATION, AND DEFORMATION USING SYNCHROTRON RADIATION — *Invited*
**B.G. Landes, R.A. Bubeck, G.H. Barnes, R.A. Newman, M.T. Bishop, C.F. Broomall, R.L. Scott, D.H. Parker,** The Dow Chemical Company, Midland, MI

2:30 D-028 LINE PROFILE ANALYSIS OF POLYMERIC FIBERS
**R. Barton, Jr., R.L. Harlow,** DuPont Company — Central Research & Development, Wilmington, DE

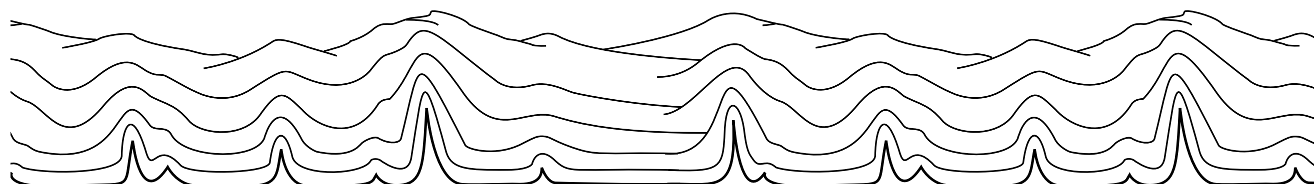
2:50 D-025 THE INFLUENCE OF POLYETHYLENE AND CARBON BLACK MORPHOLOGY ON VOID FORMATION IN CONDUCTIVE COMPOSITE MATERIALS — A SANS STUDY
**J. Oakey, D.W.M. Marr,** Colorado School of Mines, Golden, CO
**K.B. Schwartz, M. Wartenberg,** Raychem Corporation, Menlo Park, CA

3:10 Break

3:40 D-055 QUANTITATIVE POLE FIGURE ANALYSIS OF ORIENTED POLYETHYLENE FILMS — *Invited*
**J.H. Butler, S.M. Wapp, F.H. Chambon,** Exxon Chemical Company, Baytown, TX

4:10 D-122 MAGNETIC FIELD ALIGNMENT OF TRANSITION-METAL AND LANTHANIDE ION DOPED POLYMERIZABLE LIQUID CRYSTALS
**E. Juang, D.L. Gin, J.A. Reimer,** University of California, Berkeley, CA
**K.B. Schwartz,** Raychem Corporation, Menlo Park, CA

4:30 D-003 CHARACTERIZATION OF ORGANOCLAY/POLYMER NANOCOMPOSITE MORPHOLOGY BY X-RAY DIFFRACTION
**M.W. Ellsworth, K.B. Schwartz,** Raychem Corporation, Menlo Park, CA



## XRF:

## Session F-1 APPLICATIONS OF XRF TO INDUSTRIAL PROBLEMS

Organized by: **R. Jenkins,** ICDD, Newtown Square, PA
**S. Hagopian-Babikian,** Lafarge Canada, Inc., Canada

1:30 F-58 THE HISTORICAL ROLE OF XRF IN THE SOLUTION OF INDUSTRIAL PROBLEMS — *Invited*
**R. Jenkins,** ICDD, Newtown Square, PA

2:00 F-41 BORATE FUSION OF FERRO-ALLOYS — FUNDAMENTAL PRINCIPLES
**F. Claisse,** Corporation Scientifique Claisse, Inc., Canada

2:20 F-51 XRF ANALYSIS OF CEMENT — ASTM C-114 QUALIFICATION
**J. Anzelmo, A. Seyfarth, L. Arias, A. Larsen,** Bruker AXS, Inc., Madison, WI

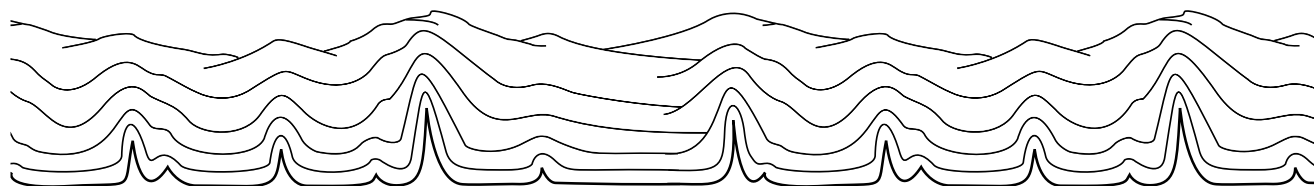
2:40 F-01 XRF IDENTIFICATION OF ALLOYS USING LOTUS APPROACH 97® DATABASE WITH ASM INTERNATIONAL® DATA
**A.J. Klimasara,** Osram Sylvania, Inc., Beverly, MA

3:00 Break

3:30 F-20 CHARACTERIZATION OF DRUM VENT FILTER CORROSION WITH MXRF IMAGING
**G.J. Havrilla, J. Bridgewater, K. Huchton, S. Chipera, S. Mecklenburg, J. Schoonover, W. Connor,** Los Alamos National Laboratory, Los Alamos, NM

3:50 F-06 ANALYSIS OF METAL ALLOYS BY EDXRF, ITS ACCURACY AND RELIABILITY
**V.I. Smolniakov, I.A. Koltoun,** Russian Academy of Sciences, Russia

4:10 F-05 EXPERIMENTAL INVESTIGATIONS OF POSSIBILITIES OF HIGH-ACCURACY ANALYSIS OF THE GOLD JEWELS
**V.I. Smolniakov, I.A. Koltoun**, Russian Academy of Sciences, Russia



**XRD & XRF:**
**Session C-3 SYNCHROTRON APPLICATIONS**

Organized by: **J.L. Jordan-Sweet,** IBM Research, Upton, NY
**B. O'Connor,** Curtin University of Technology, Western Australia

8:30 D-069 INTERPLANETARY DUST PARTICLES STUDIED BY SYNCHROTRON RADIATION — *Invited*
**K. Ohsumi,** Institute of Materials Structure Science, KEK, Japan
**M.E. Zolensky,** NASA, Johnson Space Center

9:00 D-044 X-RAY MICRODIFFRACTION STUDIES OF DISLOCATIONS IN SiGe/Si HETEROSTRUCTURES
**P.M. Mooney, J.L. Jordan-Sweet, I.C. Noyan, S.K. Kaldor,** IBM Research Division, T.J. Watson Research Center, Yorktown Heights, NY
**P.-C. Wang,** IBM Microelectronics Division, Hopewell Junction, NY

9:20 D-098 DIFFRACTION ANOMALOUS FINE STRUCTURE MEASUREMENTS OF BURIED-LAYER $Ga_{1-x} In_xAs$
**J.C. Woicik, C.E. Bouldin, B.A. Ravel,** National Institute of Standards and Technology, Gaithersburg, MD

9:40 D-108 IN SITU MONITORING OF THIN FILM REACTIONS: LOWERING THE TEMPERATURE OF THE C49-C54 PHASE TRANSFORMATION OF $TiSi_2$ — *Invited*
**C. Lavoie, C. Cabral, Jr., L.A. Clevenger, J.M.E. Harper, F.M. d'Heurle, J.L. Jordan-Sweet, R.A. Roy, K.L. Saenger,** IBM T.J. Watson Research Center, Yorktown Heights, NY
**R.W. Mann, G.L. Miles, J.S. Nakos,** IBM Microelectronics, Essex Junction, VT
**A. Quintero, M.R. Libera,** Stevens Institute of Technology, Hoboken, NJ

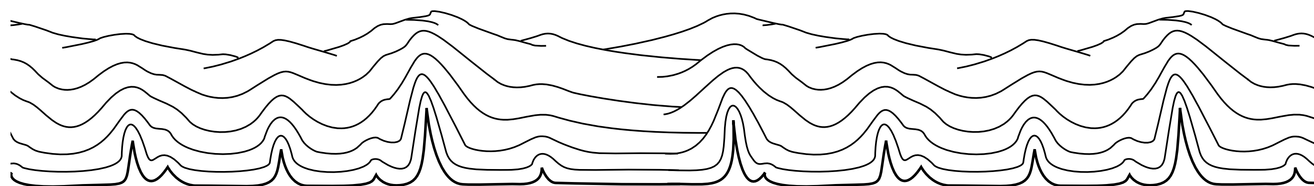
10:10 Break

10:40 C-6 APPLICATIONS OF XRF & XRD AT MICRON AND SUBMICRON SPATIAL RESOLUTION — *Invited*
**B. Lai, Z. Cai, W. Yun, J. Maser, D. Legnini, P. Ilinski, W. Rodrigues,** Advanced Photon Source, Argonne National Laboratory, Argonne, IL

11:10 D-071 SYNCHROTRON X-RAY MICRODIFFRACTION STUDY OF EPITAXIAL OXIDE FILMS ON TEXTURED NICKEL SUBSTRATES
**J.D. Budai, G.E. Ice, B.C. Larson, N. Tamura, J.-S. Chung, J.Z. Tischler, D.P. Norton,** Oak Ridge National Laboratory, Oak Ridge, TN
**E.L. Williams, W.P. Lowe,** Howard University, Washington, DC

11:30 F-24 CHEMICAL CHARACTERIZATION OF TRACE ELEMENTS BY X-RAY FLUORESCENCE WITH 3rd GENERATION SYNCHROTRON RADIATION
**H. Eba, K. Sakurai,** National Research Institute for Metals, Japan
**J. Ihara,** Sumitomo Electric Industries, LTD., Japan





**XRD:**

**Session D-4 RIETVELD APPLICATIONS II**

Organized by: **D.L. Bish,** Los Alamos National Laboratory, Los Alamos, NM
**D.K. Smith,** Emeritus, The Pennsylvania State University, University Park, PA

Chairs: **S.T. Misture,** New York State College of Ceramics at Alfred University, Alfred, NY
**G.J. McCarthy,** North Dakota State University, Fargo, ND

9:00 D-067 ATTAINING 1% ACCURACY IN ABSOLUTE PHASE COMPOSITION LEVELS BY RIETVELD ANALYSIS
**B. O'Connor, D. Li, H. Sitepu,** Curtin University of Technology, Australia

9:20 D-030 TOWARD IMPROVED QUANTITATIVE PHASE ANALYSIS OF COAL COMBUSTION BY-PRODUCTS THROUGH RIETVELD QXRD
**D.G. Grier, M.A. Wisdom, S.L. Lerach, R.B. Peterson, J.J. Walsh, R.S. Winburn, G.J. McCarthy,** North Dakota State University, Fargo, ND

9:40 D-061 QUANTITATIVE XRD ANALYSIS OF COAL COMBUSTION BY-PRODUCTS BY THE RIETVELD METHOD III. NIST SRM FLY ASHES
**R.S. Winburn, J.L. Parker, G.J. McCarthy,** North Dakota State University, Fargo, ND

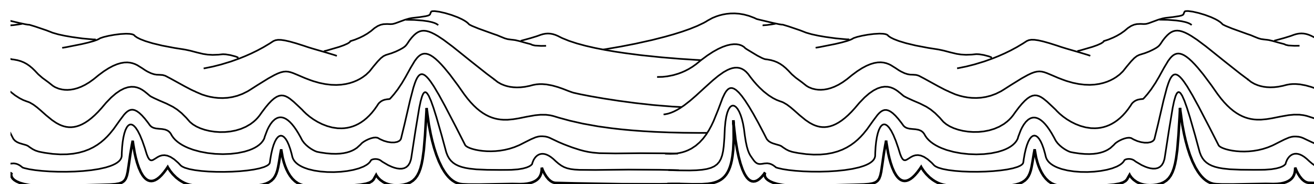
10:00 Break

10:20 D-045 USING THE RIETVELD REFINEMENT METHOD AS A PHASE FILTER FOR XRD SAMPLE ANALYSIS
**D.E. Simon,** DES Consulting, The Woodlands, TX
**R.W. Morton,** Phillips Petroleum Company, Bartlesville, OK

10:40 D-089 X-RAY DIFFRACTION ANALYSIS OF PORTLAND CEMENT: PART 1 — REFERENCE INTENSITY RATIO METHOD (RIR)
**W.G. McPherson,** Halliburton Energy Services, Duncan, OK
**D.E. Simon,** DES Consulting, The Woodlands, TX

11:00 D-090 X-RAY DIFFRACTION ANALYSIS OF PORTLAND CEMENT: PART 2 — RIETVELD REFINEMENT METHOD
**D.E. Simon,** DES Consulting, The Woodlands, TX
**W.G. McPherson,** Halliburton Energy Services, Duncan, OK





**XRD:**

**Session D-5 POLYMERS II: IN-SITU SCATTERING/DIFFRACTION CHARACTERIZATION OF POLYMERS**

Organized by: **B. Hsiao,** State University of New York at Stony Brook, Stony Brook, NY
**R. Barton, Jr.,** DuPont Experimental Station, Wilmington, DE

8:30 D-121 IN-SITU X-RAY CHARACTERIZATION OF STRUCTURE DEVELOPMENT DURING FIBER PROCESSING (SPINNING/DRAWING/AGING) — *Invited*
**J.M. Schultz,** University of Delaware, Newark, DE

9:00 D-023 SYNCHROTRON STUDIES OF POLYMERS AT HIGH SPATIAL AND TEMPORAL RESOLUTION — *Invited*
**A. Mahendrasingam, C. Martin, S. Bingham, R. Bhagat, W. Fuller,** Keele University, UK
**D.J. Blundell, R.J. Oldman,** ICI Research and Technology Centre, UK
**J.L. Harvie, D.H. MacKerron,** DuPont UK Ltd, United Kingdom

9:30 D-066 MORPHOLOGICAL CHANGES DURING CRYSTALLIZATION AND MELTING OF FLEXIBLE AND STIFF POLYMERS STUDIED BY SYNCHROTRON X-RAY
**B.B. Sauer,** DuPont Experimental Station, Wilmington, DE
**B.S. Hsiao, Z-G. Wang,** State University of New York at Stony Brook, Stony Brook, NY

9:50 D-105 THE NATURE OF SECONDARY CRYSTALLIZATION IN POLY(ETHYLENE TEREPHTHALATE)
**B.S. Hsiao, Z.G. Wang,** State University of New York at Stony Brook, Stony Brook, NY
**B.B. Sauer, H. Chang,** DuPont CR&D, Wilmington, DE
**J.M. Schultz,** University of Delaware, Newark, DE

10:10 D-074 TIME-RESOLVED X-RAY SCATTERING STUDIES ON MELTING OF POLY(TETRAMETHYLENE SUCCINATE)
**H.H. Song,** Hannam University, Korea
**E.S. Yoo, J.S. Shin, S.S. Im,** Hanyang University, Korea

10:30 Break

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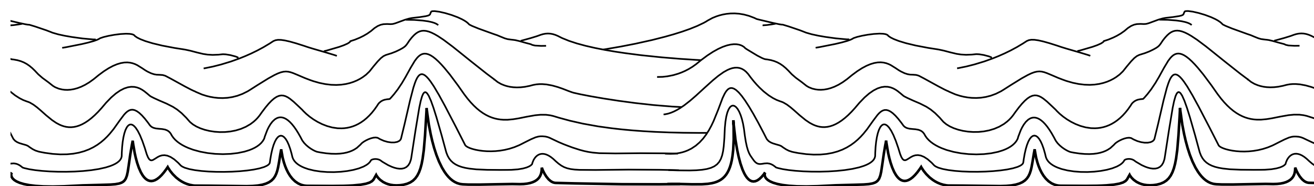


**XRD:**

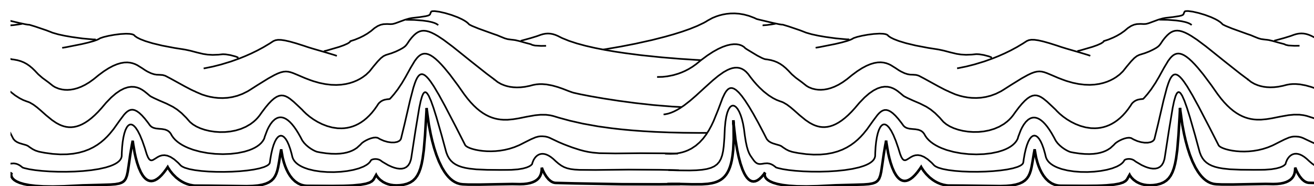
**Session D-5 POLYMERS II: IN-SITU SCATTERING/DIFFRACTION CHARACTERIZATION OF POLYMERS** (continued)

10:50 D-124 CHARACTERISATION OF POLYMER CRYSTALLISATION BY X-RAY SCATTERING TECHNIQUES — *Invited*
**J.P.A. Fairclough, A.J. Ryan,** University of Sheffield, UK
**N.J. Terrill,** CCLRC, Daresbury Laboratory, UK
**C. Booth, S.-M. Mai,** University of Manchester, UK

11:20 D-060 IN-SITU SCATTERING CHARACTERIZATION OF HOMOPOLYMERS IN SUPERCRITICAL FLUIDS
**Y.B. Melnichenko, G.D. Wignall,** Oak Ridge National Laboratory, Oak Ridge, TN
**J.D. Londono,** DuPont Central Research & Development Experimental Station, Wilmington, DE
**K.D. Heath, S. Salaniwal, H.D. Cochran,** Oak Ridge National Laboratory and University of Tennessee, Knoxville, TN
**E. Kiran,** University of Maine, Orono, ME
**M. Stamm,** Max Planck-Institut für Polymer Forschung, Germany

11:40 D-059 SMALL ANGLE NEUTRON SCATTERING FROM BLOCK COPOLYMER MICELLES IN SUPERCRITICAL CARBON DIOXIDE
**G.D. Wignall, J.D. Londono, Y.B. Melnichenko,** Oak Ridge National Laboratory, Oak Ridge, TN
**R. Triolo,** University of Palermo, Italy
**J.B. McClain, D.E. Betts, J.M. DeSimone,** University of North Carolina, Chapel Hill, NC

12:00 D-106 PHASE STRUCTURES AND MORPHOLOGIES DETERMINED BY SELF-ORGANIZATION, CRYSTALLIZATION AND VITRIFICATION IN POLY(ETHYLENE OXIDE) -*b*-POLYSTYRENE DIBLOCK COPOLYMERS
**S.Z.D. Cheng, L. Zhu, R.P. Quirk,** The University of Akron, Akron, OH
**B.S. Hsiao, F. Yeh,** The State University of New York at Stony Brook, Stony Brook, NY



**XRD:**

## Session D-6 DIFFRACTION STRESS ANALYSIS I

Organized by: **I.C. Noyan,** IBM, Yorktown Heights, NY
**T. Sasaki,** Kanazawa University, Japan

9:00 D-038 INVESTIGATIONS OF SOLID STATE REACTIONS AND PHASE TRANSITIONS IN CERAMIC MATERIALS USING NEUTRON SCATTERING — *Invited*
**E. Ustundag,** California Institute of Technology, Pasadena, CA

9:30 D-051 A LOOK AT RESIDUAL STRESS FROM VOID REGIONS IN INTEGRATED CIRCUITS
**R.G. Tissot,** Sandia National Laboratories, Albuquerque, NM

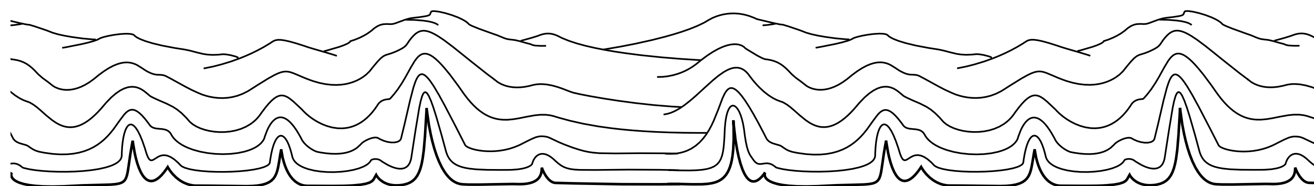
9:50 D-087 EFFECTS OF SUBSTRATE COATING WITH METAL SPRAYING ON THE PROPERTIES OF SPUTTERED TITANTUM-NITRIDE FILM
**Y. Miyoshi, H. Tanabe,** The University of Shiga Prefecture, Japan
**T. Sameshima, T. Ejima, K. Ueda,** Neos LTD., Japan

10:10 Break

10:40 D-039 RESIDUAL STRESSES IN BULK METALLIC GLASSES
**E. Ustundag, J.C. Hanan, V. Scruggs,** California Institute of Technology, Pasadena, CA
**B. Clausen, M.A.M. Bourke,** Los Alamos National Laboratory, Los Alamos, NM
**R.A. Winholtz,** University of Missouri, Columbia, MO
**J.W. Richardson,** Argonne National Laboratory, Argonne, IL

11:00 D-095 IN-SITU NEUTRON DIFFRACTION MEASUREMENT OF THE RESIDUAL STRESS IN COMPOSITE TUBING AT ELEVATED TEMPERATURES
**X.-L. Wang, C.M. Hoffmann, C.H. Hsueh, G. Sarma, C.R. Hubbard, J.R. Keiser,** Oak Ridge National Laboratory, Oak Ridge, TN

11:20 D-073 RESIDUAL STRESS ANALYSIS OF GRAPHITE/POLYMER COMPOSITES USING THE CONCEPT OF METALLIC INCLUSIONS
**D. Dragoi, P. Predecki, M. Kumosa,** University of Denver, Denver, CO
**M. Castelli,** OAI/NASA Lewis Research Center



## XRF:

## Session F-2 ANALYSIS OF THIN FILMS BY XRF

Organized by: **R. Wilson,** Rigaku/USA, Inc., Danvers, MA
**G.J. Havrilla,** Los Alamos National Laboratory, Los Alamos, NM

9:00 F-59 BARIUM STRONTIUM TITANATE THIN FILM ANALYSIS — *Invited*
**T. Remmel,** Motorola, Inc., Tempe, AZ
**M. Schulbert,** Novellus, San Jose, CA
**K. Singh,** Applied Materials, Santa Clara, CA
**S. Fujimura,** Rigaku Industrial Corporation, Japan
**S. Owens, R. Deslattes,** National Institute of Standards and Technology, Gaithersburg, MD
**J. Pedulla,** J. Pedulla Associates, Silver Spring, MD
**J. Averitt,** Philips Electronic Instruments Co., Tempe, AZ

9:30 F-44 MAPPING $SiO_2$ THICKNESS ON Si WAFERS USING A POLYCAPILLARY-OPTIC-BASED X-RAY FLUORESCENCE ANALYSIS SYSTEM
**N. Gao, R. Kerr, Q. Xiao,** X-ray Optical Systems, Inc., Albany, NY

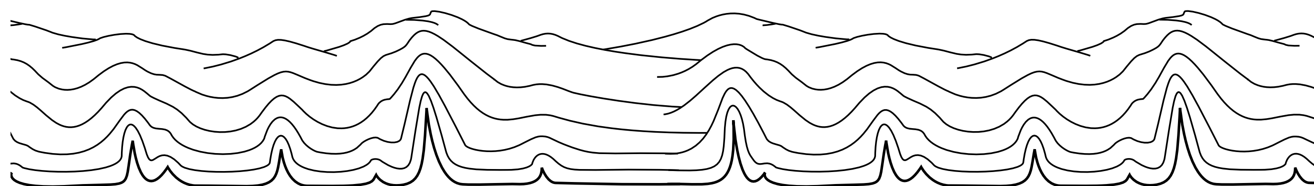
9:50 F-43 QUALITY CONTROL IN LAYER THICKNESS TESTING WITH MICRO X-RAY FLUORESCENCE SPECTROSCOPY
**A. Wittkopp, M. Haschke, U. Theis, W. Scholz,** Röntgenanalytik Messtechnik GmbH, Germany
**B. Scruggs,** EDAX Inc., NJ

10:10 Break

10:40 F-11 COMPOSITION ANALYSIS OF BST/SRO STACKED FILMS BY GIXRF
**S. Terada, H. Furukawa, H. Murakami, K. Nishihagi,** TECHNOS Co., Ltd., Japan

11:00 F-04 RESEARCH IN QUANTITATIVE X-RAY FLUORESCENCE MICROANALYSIS OF PATTERNED THIN FILMS
**M. Lankosz,** University of Mining and Metallurgy, Poland
**J.R. Sieber, J. Pedulla,** National Institute of Standards and Technology, Gaithersburg, MD

11:20 F-02 APPLICATION OF MICRO-BEAM X-RAY FLUORESCENCE SPECTROMETRY FOR QUANTITATIVE ELEMENTAL MAPPING AND CHARACTERIZATION OF THE HOMOGENEITY OF ELEMENTS DISTRIBUTION IN POLYMER FOILS
**D. Wegrzynek, B. Holyñska,** University of Mining and Metallurgy, Poland



**XRF:**

**Session F-3 MATHEMATICAL METHODS FOR XRF**

Organized by: **M. Mantler,** Vienna University of Technology, Austria
**J. Criss,** Criss Software, Largo, MD

8:10 F-61 ED-XRF SPECTRUM EVALUATION AND QUANTITATIVE ANALYSIS USING MULTIVARIATE AND NONLINEAR TECHNIQUES — *Invited*
**P. Van Espen, P. Lemberge,** Micro and Trace Analysis Center (MiTAC), University of Antwerp, Belgium

8:40 F-45 AN UPDATE TO NRLXRF AND NBSGSC
**W.T. Elam,** Naval Research Laboratory, Washington, DC
**J.R. Sieber**, National Institute of Standards and Technology, Gaithersburg, MD

9:00 F-36 VIRTUAL-XRF: A PACKAGE OF COMPUTER PROGRAMS FOR TEACHING (AND LEARNING) XRFA
**M. Mantler,** Vienna University of Technology, Vienna, Austria

9:20 F-30 THE EFFECT OF DIFFERENT STANDARD PREPARATION TECHNIQUES FOR NARROW RANGE X-RAY FLUORESCENCE CALIBRATION
**S.H. Nettles,** Construction Technology Laboratories, Inc., Skokie, IL

9:40 F-21 IMPROVEMENTS IN MXRF QUANTIFICATION USING DRIED SPOT METHODOLOGY
**G.J. Havrilla, L. Colletti,** Los Alamos National Laboratory, Los Alamos, NM

10:00 Break

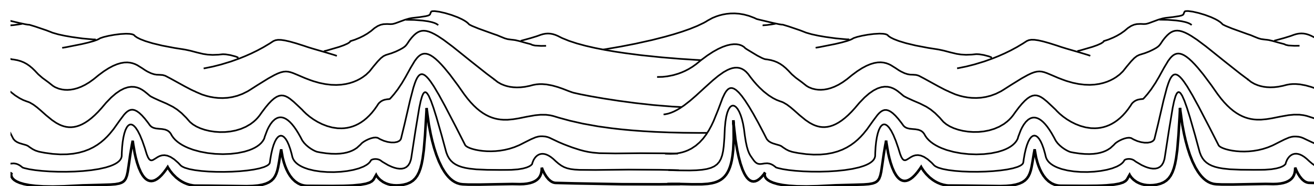
10:20 F-23 QUANTITATIVE ELEMENTAL IMAGING OF URANIUM ALLOY
**G.J. Havrilla, C. Worley,** Los Alamos National Laboratory, Los Alamos, NM

10:40 F-26 SIGNAL PROCESSING TECHNIQUES FOR PROPORTIONAL COUNTER BASED XRF MEASUREMENT SYSTEM
**T. He,** CMI International Corporation, Elk Grove Village, IL

11:00 F-12 THE CONCEPT OF THE INFLUENCE COEFFICIENT IN XRF ANALYSIS
**R.M. Rousseau,** Geological Survey of Canada, Canada

11:20 F-13 THE USE OF MONITORS FOR THE INSTRUMENTAL DRIFT CORRECTION
**R.M. Rousseau,** Geological Survey of Canada, Canada

11:40 F-14 SOME REFLECTIONS ON DETECTION LIMITS
**R.M. Rousseau,** Geological Survey of Canada, Canada



## XRD:

## Session D-7 HIGH RESOLUTION XRD

Organized by: **P.M. Mooney,** IBM T.J. Watson Research Center, Yorktown Heights, NY
**K. Kavanagh,** University of California–San Diego, LaJolla, CA

1:30 D-109 SPECULAR AND DIFFUSE X-RAY SCATTERING FROM THE SURFACES AND INTERFACES OF EPITAXIAL FILMS — *Invited*
**P.F. Miceli,** University of Missouri–Columbia, Columbia, MO

2:00 D-052 THERMAL EXPANSION OF GaN AND SUBSTRATES AT HIGH TEMPERATURES AND RESULTING EPITAXIAL MISFITS
**C.J. Rawn,** Oak Ridge National Laboratory, Oak Ridge, TN
**J. Chaudhuri,** Wichita State University, Wichita, KS

2:20 D-119 THE IMPACT OF MISORIENTATION AND DOPING ON THE RELAXATION OF InGaAs EPILAYERS GROWN ON InP
**P.P. Larrabure, K.L. Kavanagh, H.H. Wieder,** University of California–San Diego, La Jolla, CA

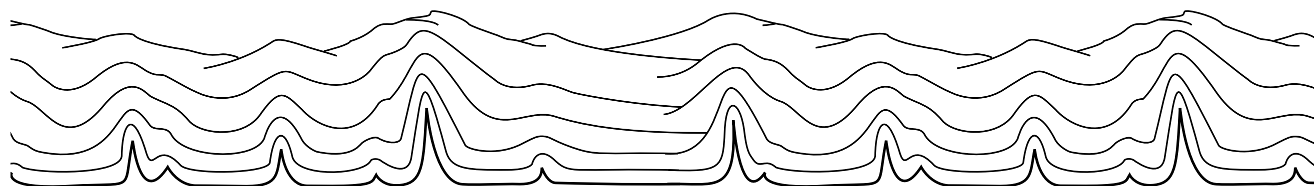
2:40 D-019 CHARACTERIZATION OF SEMICONDUCTOR HETEROSTRUCTURES ON SUBSTRATES HAVING HIGH DEFECT DENSITIES USING TRIPLE-AXIS X-RAY DIFFRACTION
**P.M. Mooney, J.O. Chu, J.A. Ott, J.L. Jordan-Sweet,** IBM T.J. Watson Research Center, Yorktown Heights, NY

3:00 Break

3:30 D-024 HIGH RESOLUTION X-RAY MEASUREMENTS OF STRAIN-MEDIATED DIFFUSION IN $CuInSe_2$ — *Invited*
**P. Fons, S. Niki, A. Yamada, H. Oyanagi,** Electrotechnical Laboratory, Optoelectronics Division, Japan

4:00 D-063 CHARACTERIZATION OF THE SILICON ON INSULATOR (SOI) FILM IN BONDED WAFERS BY HIGH RESOLUTION X-RAY DIFFRACTION
**G.M. Cohen, P.M. Mooney, E.C. Jones, K.K. Chan, P.M. Solomon, H-S.P. Wong,** IBM T.J. Watson Research Center, Yorktown Heights, NY

4:20 D-125 OVER-RELAXATION OF $Al_{.52}In_{.48}Sb$ GROWN ON InSb
**J.A. Olsen, E.L. Hu,** University of California–Santa Barbara, Santa Barbara, CA



**XRD:**

## Session D-8 POLYMERS III: CHARACTERIZATION OF COMPLEX MESOSTRUCTURES USING SMALL ANGLE SCATTERING

Organized by: **T.J. Bunning,** Air Force Research Laboratory, WPAFB, OH
**R.A. Vaia,** Air Force Research Laboratory, WPAFB, OH

2:00 D-123 UNIFIED ANALYSIS OF USAXS/SAXS: NANO-STRUCTURAL SCALING REGIMES — *Invited*
**G.Beaucage,** University of Cincinnati, Cincinnati, OH

2:30 PHASE BEHAVIOR OF BLOCK COPOLYMER BLENDS — *Invited*
**R. Krishnamoorti,** University of Houston, Houston, TX

3:00 D-010 SELF-ORGANIZED AND FIELD ASSISTED HIERARCHICAL STRUCTURES IN LIQUID CRYSTALLINE AND SEMICRYSTALLINE BLOCK COPOLYMERS
**E.L. Thomas, C. Osuji, C. Park, C. DeRosa,** M.I.T. Cambridge, MA

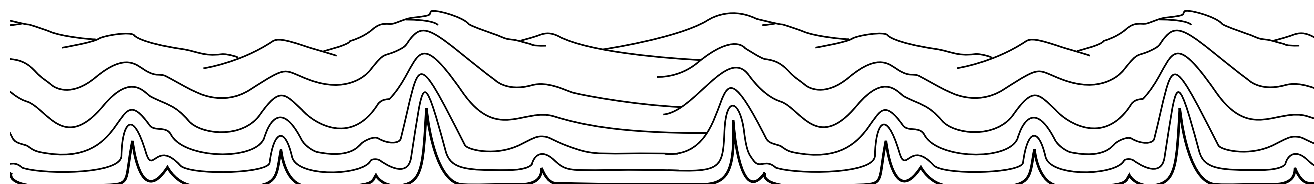
3:20 D-036 STATIC AND DYNAMIC SAXS/SEMS INVESTIGATIONS OF POLYMER DISPERSED LIQUID CRYSTAL FILMS
**D.W. Tomlin, M.D. Schulte, T.J. Bunning, R.A. Vaia,** Air Force Research Laboratory, Wright-Patterson AFB, OH

3:40 Break

4:00 D-016 FRUSTRATED POLYMER CRYSTAL STRUCTURES — *Invited*
**B. Lotz,** Institut Charles Sadron, France

4:30 D-054 INFLUENCE OF NANOSCALE INORGANIC LAYERS ON THE STRUCTURE OF SEMI-CRYSTALLINE POLYMERS
**D.M. Lincoln, R.A. Vaia,** Air Force Research Laboratory, Wright-Patterson AFB, OH
**R. Krishnamoorti,** University of Houston, Houston, TX

4:50 D-040 STUDIES OF THE EFFECTS OF STRAIN AND TEMPERATURE ON THE LAMELLAR STRUCTURE OF POLYMERS USING SMALL-ANGLE X-RAY SCATTERING
**N.S. Murthy,** AlliedSignal, Inc., Morristown, NJ
**D.T. Grubb,** Cornell University, Ithaca, NY
**B. Hsiao, Z-G. Wang,** State University of New York at Stony Brook, Stony Brook, NY



**XRD:**

**Session D-9 DIFFRACTION STRESS ANALYSIS II**

Organized by: **I.C. Noyan,** IBM, Yorktown Heights, NY

Chairs: **A. Kämpfe,** Universität Karlsruhe, Germany
**Y. Hirose,** Kanazawa University, Japan

2:00 D-015 RESIDUAL STRESS ANALYSIS, A USEFUL TOOL TO ACCESS THE FATIGUE BEHAVIOR OF STRUCTURAL COMPONENTS — *Invited*
**B. Scholtes,** University of Kassel, Germany

2:30 D-120 TWO-DIMENSIONAL DETECTORS FOR X-RAY STRESS ANALYSIS ON POLYCRYSTALLINE MATERIALS — *Invited*
**A. Kämpfe, B. Eigenmann, E. Macherauch, D. Löhe,** Universität Karlsruhe (TH), IWKI, Germany
**B. Kämpfe**, FHG IZM, Germany
**S. Goldenbogen,** ddp goldenbogen, Germany

3:00 D-085 X-RAY STUDY OF INHOMOGENITY OF SURFACE RESIDUAL STRESSES AFTER SHOT-PEENING TREATMENT
**V. Monin,** Saint Petersburg Technical University, Russia
**R.J. Teodosio, T. Gurova,** Universidade Federal do Rio de Janeiro, Brazil
**J.T. Assis,** Instituto Politécnico da Universidade Estadual do Rio de Janeiro, Brazil

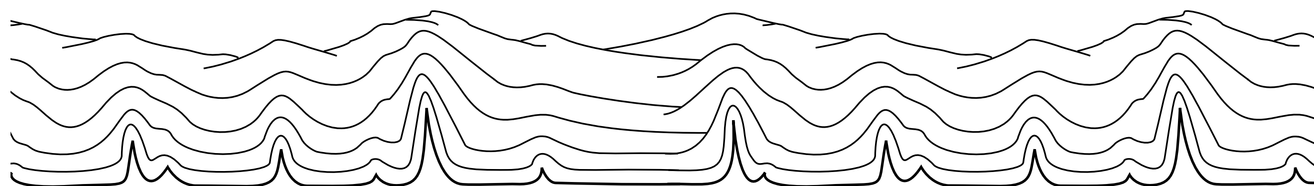
3:20 Break

3:40 D-042 THE USE OF PARALLEL BEAM OPTICS IN X-RAY STRESS ANALYSIS
**B. Houtman, J. te Nijenhuis, A.C. Vermeulen,** Philips Analytical, The Netherlands

4:00 D-096 NEW PORTABLE DIFFRACTOMETER AND RESIDUAL STRESS ANALYSIS OF THE FATIGUE BEHAVIOUR OF STRUCTURAL COMPONENTS
**A.V. Lutsau, B.N. Kodess, V.K. Ovcharov, A.Y. Boyko, A.V. Gollandtsev, D.B. Matveyev, A.V. Kotelkin, A.D. Zvonko,** VNIIMS, Moscow, Russia; ICS&E, Denver, CO; MTU, Moscow, Russia

4:20 D-057 OVERVIEW OF RESIDUAL STRESS MEASUREMENT WITH 2D DETECTORS
**B.B He, K.L. Smith, U. Preckwinkel,** Bruker Analytical X-ray Systems, Inc., Madison, WI

4:40 D-086 THE PORTABLE X-RAY APPARATUS BOTH FOR STRESS MEASUREMENTS AND PHASE ANALYSIS "IN-FIELD" CONDITIONS
**V. Monin,** Saint Petersburg Technical University, Russia
**R.J. Teodosio, T. Gurova,** Universidade Federal do Rio de Janeiro, Brazil



**XRF:**

**Session F-4 TXRF: SEMICONDUCTOR APPLICATIONS, MICRO/CHEMICAL APPLICATIONS, INSTRUMENTATION/THIN FILMS**

Organized by: **P. Wobrauschek,** Atominstitut der Österreichischen Universitäten, Vienna, Austria
**M.A. Zaitz,** IBM Microelectronics, Hopewell Junction, NY
**A. Prange,** GKSS Research Center, Germany

1:30 F-60 TXRF MAPPING TO IDENTIFY VARIOUS PATTERNS OF SURFACE METAL CONTAMINATION — *Invited*
**M.A. Zaitz,** IBM Microelectronics, Hopewell Junction, NY

2:00 F-09 PRESENT STATE OF THE ART OF THE DETERMINATION OF ULTRA-TRACE CONTAMINANTS ON SILICON WAFER SURFACES USING TXRF— *Invited*
**S. Pahlke, L. Fabry, L. Kotz, T. Ehmann,** Wacker Siltronics AG, Germany

2:30 F-25 DEFINITIVE STUDY OF THE POTENTIAL INTERFERENCES TO LIGHT ELEMENT TXRF USING W-Mα EXCITATION
**M. Funahashi, H. Kohno, M. Matsuo,** Rigaku Industrial Corporation, Japan
**R. Wilson,** Rigaku/USA, Danvers, MA

2:50 Break

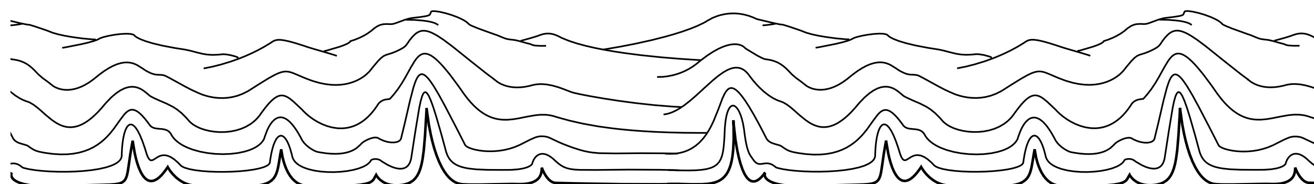
3:10 F-07 EXTENDED FIELDS OF APPLICATION USING A NEW TECHNICAL CONCEPT FOR TXRF INCLUDING ANALYTICAL QUALITY ASSURANCE — *Invited*
**A. Prange,** GKSS – Research Centre, Institute for Physical and Chemical Analysis, Germany

3:40 F-18 TXRF OF LOW Z ELEMENTS — IMPROVEMENTS AND APPLICATIONS
**C. Streli, P. Wobrauschek, P. Kregsamer,** Atominstitut der Österreichischen Universitäten, Austria
**P. Pianetta,** Stanford Synchrotron Radiation Lab., Stanford, CA
**S. Pahlke, L. Fabry,** Wacker Siltronic, Germany
**L. Palmetshofer,** University of Linz, Austria
**L. Brehm,** DOW Chemical, Midland, MI

4:00 F-57 ANALYSIS OF NATURAL WATERS BY TXRF USING AN ELECTROCHEMICAL PRECONCENTRATION METHOD — *Invited*
**A. Ritschel, P. Wobrauschek,** Atominstitut der Österreichischen Universitäten, Austria
**E. Chinea,** Centro de Estudios Aplicados al Desarolla Nuclear, Cuba

4:30 F-47 THIN-LAYER ANALYSIS OF SILICON WAFERS BY TXRF — *Invited*
**R. Klockenkämper, A. von Bohlen,** Institute für Spektrochemie und Angewandte Spectroskopie — ISAS, Germany

5:00 F-28 THE ANALYTICAL POSSIBILITIES OF A PORTABLE TXRF-SPECTROMETER
**U. Waldschläger,** INTAX GmbH, Germany



**XRD & XRF:**

**Session C-4 NON-TRADITIONAL PARADIGMS IN DATA PROCESSING**

Organized by: **H. Wern,** HTW des Saarlandes, University of Applied Sciences, Germany
**I.C. Noyan,** IBM, Yorktown Heights, NY

8:30 D-041 COMPARISON OF WAVELET AND TRADITIONAL METHODS TO EVALUATE RESIDUAL STRESS GRADIENTS MEASURED BY X-RAY DIFFRACTION — *Invited*
**L. Suominen,** Stresstech Oy, Jyvaskyla, Finland
**D. Carr,** American Stress Technologies, Inc., Pittsburgh, PA

9:00 D-020 EVALUATION OF RESIDUAL STRESS GRADIENTS BY DIFFRACTION METHODS WITH WAVELETS; A NEURAL NETWORK APPROACH — *Invited*
**H. Wern,** HTW des Saarlandes, University of Applied Sciences, Germany

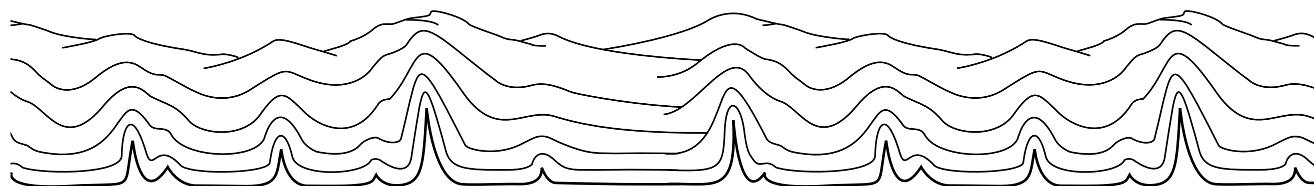
9:30 D-008 MATHEMATICAL PROPERTIES OF DIFFRACTION POLE FIGURES
**H. Schaeben,** Freiberg University of Technology and Mining, Germany

9:50 D-011 THE DE LA VALLEE POUSSIN DISTRIBUTION IN TEXTURE ANALYSIS
**H. Schaeben**, Freiberg University of Technology and Mining, Germany

10:10 Break

10:30 D-091 A NEW FUNDAMENTAL PARAMETERS APPROACH
**A. Coelho, A. Kern,** Bruker AXS GmbH, Germany
**P.J. LaPuma,** Bruker AXS, Inc., Madison, WI

10:50 D-050 X'PERT TEXTURE: A NEW TOOL TO PROCESS THE X-RAY TEXTURE DATA
**D.I. Nikolayev, V. Luzin, T. Lychagina,** Joint Institute for Nuclear Research, Russia
**A.A. Dzjuba, V.A. Kogan, J. te Nijenhuis,** Philips Analytical, The Netherlands



**XRD & XRF:**

**Session C-5 X-RAY INSTRUMENTATION & OTHER APPLICATIONS**

Organized by: **G. Berti,** Universita' di Pisa, Italy
**D. Broton,** Construction Technology Laboratories, Skokie, IL

8:00 D-065 APPLICATIONS OF POLYCAPILLARY OPTICS FOR POWDER DIFFRACTION
**S.T. Misture,** New York State College of Ceramics at Alfred University, Alfred, NY
**M. Haller,** X-ray Optical Systems, Inc., Albany, NY

8:20 D-034 TECHNIQUES AND LABORATORY APPLICATIONS FOR FOCUSED BEAM X-RAY DIFFRACTION
**D.K. Bowen, G. Fraser, N. Loxley, J. Wall,** Bede Scientific Instruments Ltd., UK
**L. Pina, A. Inneman, R. Hudec,** Reflex sro, Prague CZ

8:40 D-031 USING A TAPERED MONOCAPILLARY OPTIC TO PRODUCE A 30 μm X-RAY BEAM FOR MICRODIFFRACTION ANALYSIS
**R.C. Chan, C.G. Cleaver, J.P. Heuer, J.L. Lakner, R.L. Lewis,** Schafer Corporation, Sunol, CA
**I. Ponomarev, N. Gao,** X-ray Optical Systems, Inc., Albany, NY

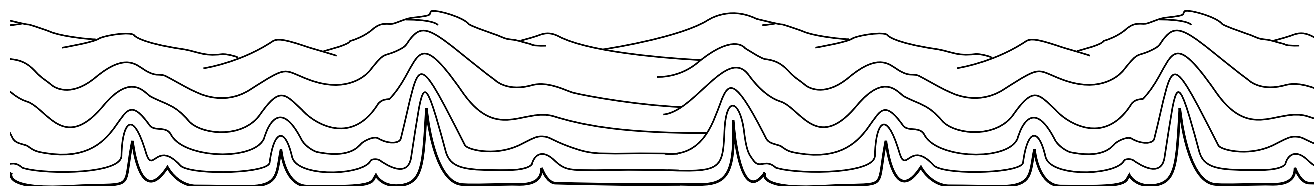
9:00 D-072 BEAM COLLIMATION USING POLYCAPILLARY X-RAY OPTICS FOR LARGE AREA DIFFRACTION APPLICATIONS
**S.D. Padiyar, H. Wang, W.M. Gibson, C.A. MacDonald,** University at Albany, SUNY, Albany, NY
**M.V. Gubarev,** NASA, Huntsville, AL

9:20 D-017 PARALLEL BEAM METHODS IN POWDER DIFFRACTION AND TEXTURE IN THE LABORATORY
**R.A. Clapp,** Diffraction Technology Pty. Ltd., Australia
**M. Haller,** X-ray Optical Systems, Inc., Albany, NY

9:40 D-049 GRADED d-SPACING MULTILAYER OPTICS FOR VARIOUS ENERGIES
**B. Verman, B. Kim, D. Wilcox, D. Broadway, Y. Platonov, N. Grupido, L. Jiang,** Osmic, Inc., Troy, MI

10:00 Break

(continued on next page)



**XRD & XRF:**

**Session C-5 X-RAY INSTRUMENTATION & OTHER APPLICATIONS** (continued)

10:20 F-22 INTEGRATED SPECTROSCOPIC CHEMICAL IMAGING: MXRF, MRAMAN, MIR
**G.J. Havrilla,** Los Alamos National Laboratory, Los Alamos, NM

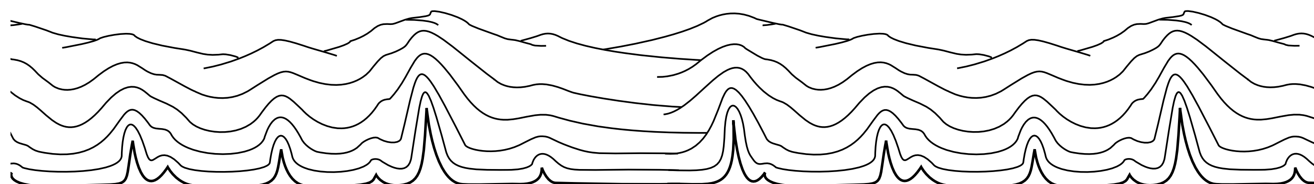
10:40 D-047 X-RAY CHARACTERIZATION OF RESISTOR/DIELECTIC MATERIAL FOR LOW TEMPERATURE CO-FIRED CERAMIC PACKAGES
**M.A. Rodriguez, P. Yang, D. Dimos,** Sandia National Laboratories, Albuquerque, NM

11:00 D-116 AMBIGUITIES OF MICRO AND NANO STRUCTURAL DETERMINATION
**G. Berti,** Universita' di Pisa, Italy

11:20 D-115 ACCURACY OF XRPD MEASUREMENT VIA DIFFRACTION INSTRUMENTAL MONITORING
**G. Berti,** Universita' di Pisa, Italy

11:40 D-056 FUNDAMENTALS OF TWO-DIMENSIONAL X-RAY DIFFRACTION ($XRD^2$)
**B.B. He, U. Preckwinkel, K.L. Smith,** Bruker Analytical X-ray Systems, Inc., Madison, WI

12:00 F-39 CRYOGENIC MICROCALORIMETERS FOR HIGH RESOLUTION ENERGY DISPERSIVE X-RAY SPECTROMETRY
**J. Höhne, M. Bühler, T. Hertrich,** CSP Cryogenic Spectrometers GmbH, Germany
**M. Altmann, G. Angloher, F.v. Feilitzsch, T. Frank, P. Hettl, J. Jochum, T. Nüßle, S. Pfnür, J. Schnagl, S. Wänninger,** Technische Universität München, Germany



**XRF:**

**Session F-5 APPLICATIONS OF XRF: ENVIRONMENTAL PROBLEMS AND LOW DETECTION LIMITS**

Organized by: **Y. Gohshi,** National Institute for Environmental Studies, Japan
**N. Dando,** ALCOA, Alcoa Technical Center, PA

8:10 F-32 X-RAY EMISSION ANALYSIS OF VOLATILE AND NON-VOLATILE METALS IN THE ENVIRONMENT — *Invited*
**S. Török,** KFKI Atomic Energy Research Institute, Hungary

8:40 F-42 ULTRA TRACE ANALYSIS BY MICRO X-RAY FLUORESCENCE SPECTROSCOPY
**B. Scruggs,** EDAX Inc., Mahwah, NJ
**M. Haschke, P. Pfannekuch,** Röntgenanalytik Messtechnik GmbH, Germany

9:00 F-31 ANALYSIS OF HEAVY METALS AND OTHER TOXIC ELEMENTS USING XRF: COMPARISON OF QUANTITATIVE AND "STANDARD-LESS" APPROACHES
**R. Yellepeddi, D. Bonvin, A. Kohler,** ARL SA, Switzerland

9:20 F-10 ENVIRONMENTAL ANALYSIS USING MONOCHRO SOURCE EDXRF — *Invited*
**K. Nishihagi, S. Terada,** TECHNOS Co., Ltd., Japan
**T. Wakisaka, N. Morita, M. Wakasa,** Kao Corporation, Japan

9:50 Break

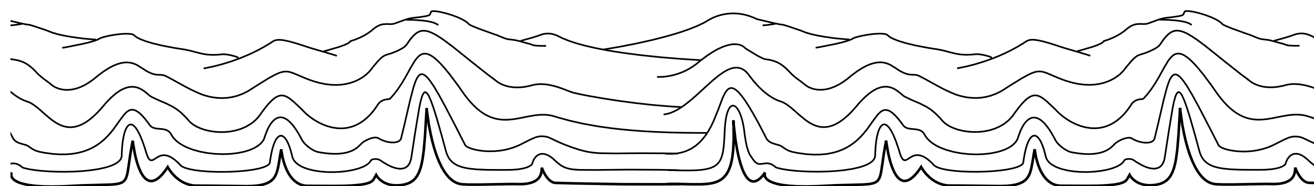
10:10 F-03 TIME DEPENDENT CHARACTERIZATION OF OMBROTROPHIC PEAT CORES TAKEN FROM POLAND AND AUSTRIA FOR STUDYING ATMOSPHERIC DEPOSITION OF METALS USING X-RAY FLUORESCENCE TECHNIQUES
**B. Holyñska, B. Ostachowicz, J. Ostachowicz, L. Samek, P. Wachniew,** University of Mining and Metallurgy, Poland
**E. Madeyska,** Institute of Botany, Polish Acad. Of Science, Poland
**P. Wobrauschek, C. Streli, G. Halmetschlager,** Atominstitut of the Austrian Universities, Austria

10:30 F-49 DEVELOPMENT OF AN AUTOMATED SAMPLE PREPARATION STATION FOR MICROSAMPLE X-RAY ANALYSIS (MXA)
**D. Clark Turner, E.C. Anderson, B. Shumway,** Process Analytics, Orem, UT

10:50 F-48 PREPARATION AND CHARACTERIZATION OF DRIED-RESIDUE CALIBRATION STANDARDS FOR USE IN MICROSAMPLE X-RAY ANALYSIS (MXA)
**E.C. Anderson, B. Shumway, D. Clark Turner,** Process Analytics, Orem, UT

11:10 F-34 APPLICATION OF X-RAY MICROFLUORESCENCE SPECTROMETRY FOR LOCALIZED AREA ANALYSIS OF BIOLOGICAL AND ENVIRONMENTAL MATERIALS
**J.R. Sieber,** National Institute of Standards and Technology, Gaithersburg, MD
**M. Lankosz, M. Boruchowska,** University of Mining and Metallurgy, Poland

11:30 F-15 CHARACTERIZATION OF Pu-RICH PARTICLES BY X-RAY MICROFLUORESCENCE
**M. Mattiuzzi, A. Markowicz, P.R. Danesi,** IAEA Laboratories, Seibersdorf, Austria



# Summer Activities*

**Steamboat Springs Pro Rodeo Series:** PRCA-sanctioned, award-winning rodeo; downtown.

**River Tubing:** Includes shuttle; available on the Yampa River from Rotary Park to downtown.

**Whitewater Rafting:** Half day and full day trips available, including lunch and transportation.

**Strings in the Mountains Concert Series:** Early July through August; adjacent to the hotel featuring renowned international musicians.

**Mountain Bike Trails:** At the Steamboat Ski Area; can be accessed from the Sheraton.

**Kids' Adventure Club:** All day supervised activities for children 4–12; includes lunch.

**Golf—Sheraton's Robert Trent Jones II:** 18-hole championship mountain course.

**Golf—Haymaker Golf Course:** Links style municipal course.

**Horseback Riding:** 1 hour, 2 hour, half and full day trips at several locations.

**Stream and Lake Fishing:** At Steamboat Lake or Stagecoach Reservoir.

**Miniature Golf:** Available downtown and next to the Chamber building.

**Hot Air Balloon Rides:** A scenic adventure above the Yampa Valley.

**Bicycle Rentals and Tours:** Available on the mountain or downtown.

**Fish Creek Falls:** One of Steamboat's most popular attractions!

**Hiking:** Inquire about the area's expansion hiking trail system.

**Trail Steak Dinner Rides:** Several scenic locations available.

**Nature Walks:** Walking maps available for self-guided tours.

**Gondola Rides:** On the Silver Bullet high-speed gondola.

**Floating River Fishing:** On the Elk or Yampa Rivers.

**Bowling:** The Snowbowl, located west of Steamboat.

**Kayaking:** On the Yampa River's kayak course.

**Rock Climbing:** Half day outing available.

*Most activities may be booked with Sheraton's Concierge Staff, located in hotel lobby, Ext. 1005.*

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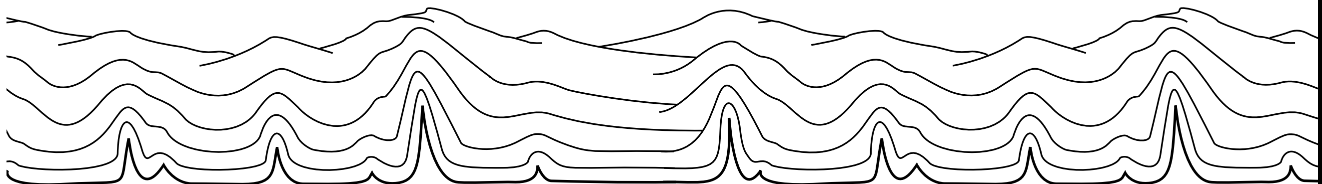

# Directions to Steamboat Springs*

## Driving from Denver International Airport

The opportunity to drive to Steamboat Springs may be a high point of your Colorado adventure. You'll see wildlife, blue skies, beautiful mountain scenery and wide open ranch lands. It is an easy drive from Denver, but it will take you worlds away!

Steamboat is just 169 miles from Denver International Airport (DIA), or a pleasant 3.5 hour drive. From Denver, head west on I-70 through the Eisenhower Tunnel. En route, you'll pass historic Georgetown, with its numerous antique shops and a viewing area of Rocky Mountain bighorn sheep. On the western side of the Eisenhower Tower, exit on Colorado 9 at Silverthorn. Here you'll find factory outlet shops from Liz Claiborne to Levi!

From Silverthorn, head north on Colorado 9 along the Blue River, 40 minutes to Kremmling, the hunting capital of Northwest Colorado.

Turn left onto US Highway 40 toward Steamboat, just 53 miles west. En route, you'll pass through the Rockies' high plains and grazing lands before you begin a gradual ascent to the famed Rabbit Ears Pass. Be sure to look for the "Ears" rock formation.

Upon decending the pass, you'll see Lake Catamount on your left, next to the popular Stagecoach Resevoir State Park. You'll also be able to view the Flat Tops Wilderness Area and part of the Gore Range, that surrounds Vail, in the distance. The Yampa Valley will unfold before you, and as the legend goes, you will then be captivated and always want to return! The highway leads right to the Mt. Werner exit, which takes you to the Sheraton Steamboat Resort. Follow Mt. Werner Road north to Mt. Werner Circle; look for the Sheraton Steamboat Resort.

## Driving from Yampa Valley Regional Airport in Hayden

Yampa Valley Regional Airport (HDN) in Hayden is located 22 miles west of Steamboat on US Highway 40. Driving to Steamboat, follow US Highway 40 east to the Mt. Werner exit, turn north on Mt. Werner Road to Mt. Werner Circle and the Sheraton Steamboat Resort.

## Ground Transportation

Another option from either Yampa Valley Regional Airport (HDN) in Hayden or Denver International Airport (DIA) is to book a shuttle. This is a nice option for those who simply want to sit back and enjoy the scenery, and leave all the driving to someone else! Alpine Taxi out of Steamboat, offers this service from both DIA and the Yampa Valley Regional Airport. 800-343-RIDE

Once in Steamboat, the city offers complimentary scheduled shuttle service throughout the town and ski area.

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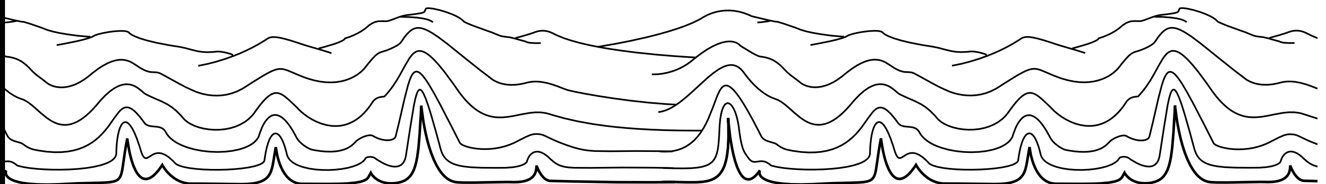
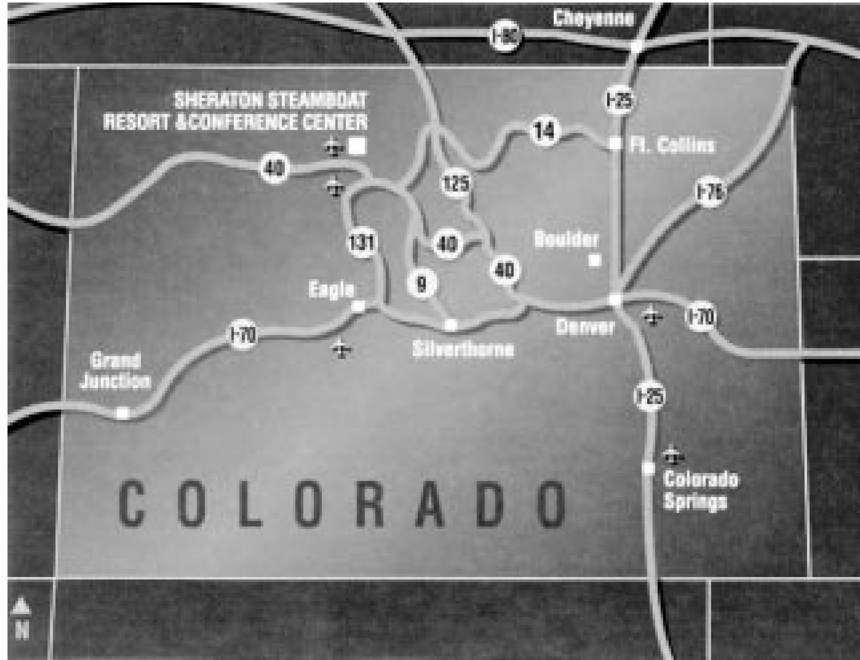
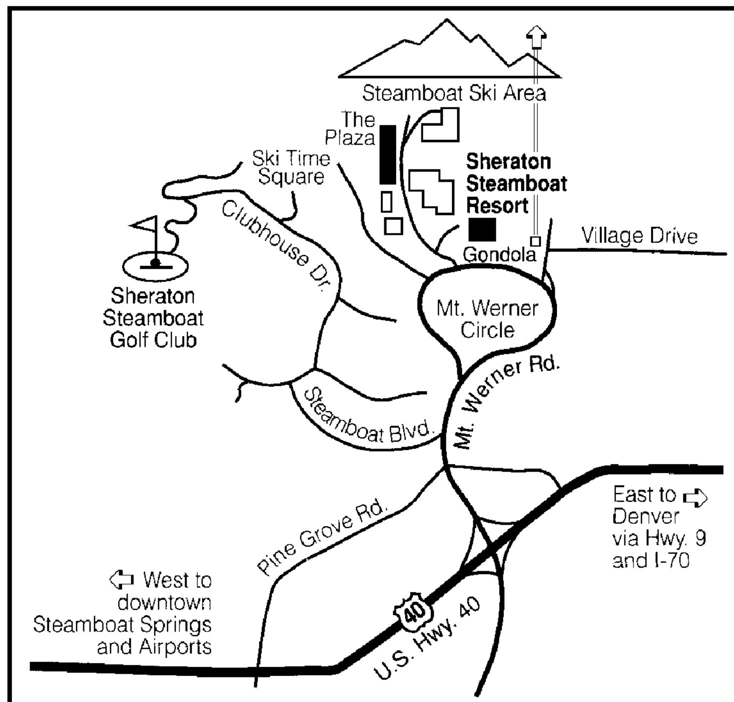


# Area Maps*

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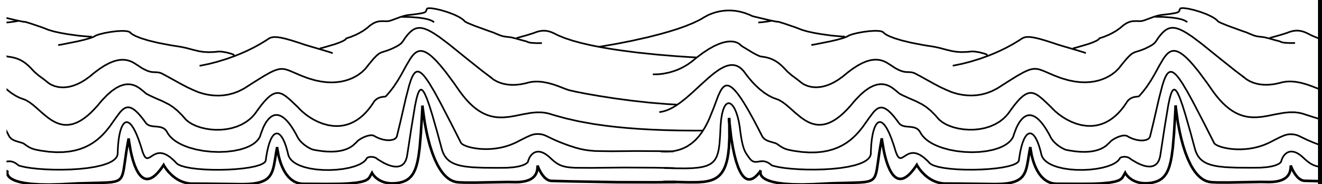
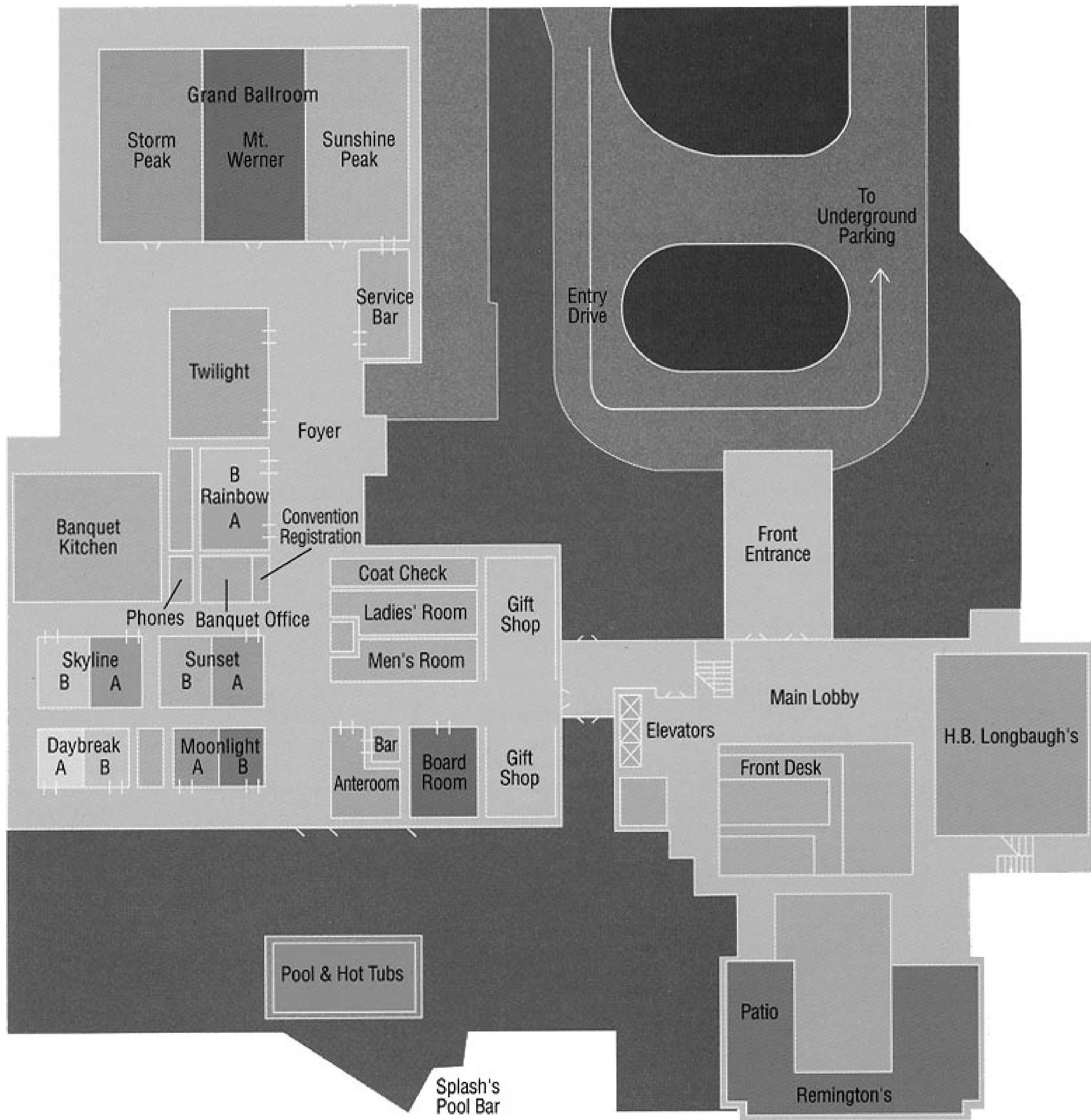


# Sheraton Steamboat Resort*

## Hotel Layout

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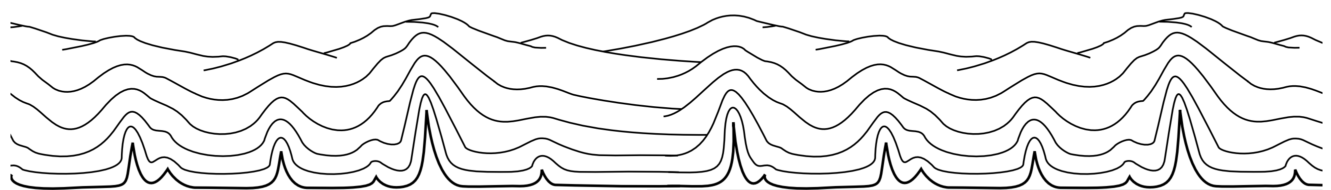
# Program-At-A-Glance

## 2–6 August 1999

| Day & Time | XRD & XRF | XRD | XRF |
|---|---|---|---|
| **Sun. eve.:** 5:30–7:30 **Welcoming Reception** Sponsored by: Bede Scientific, SPEX CertiPrep & Claisse Scientifique (**SP**) | | | |
| **MON. am:** **Workshops** | **W-1** Use of the Web as a Resource **Kottenhahn/Faber (TWI)** | **W-2** ISO 9000 and Standards—XRD **Goldsmith (SP)** | **W-3** How to Set Up an XRF Analytical Process **Jenkins** |
| **MON. pm:** **Workshops** | | **W-4** Two-dimensional Detectors **Blanton (BR)** | **W-5** Quantitative XRF—Standardless Methods **Anzelmo (SP)** |
| **MON. eve.:** 6:30–8:30 **Bruker AXS, Inc. Reception** and **XRF Poster Session** (Chairs: Havrilla/Ebel) Sponsored by: Bruker AXS, Inc. **(SP)** | | | |
| **TUE. am:** **Workshops** | **W-6** Accuracy Through Optimum Calibration **Jenkins/Synder (SP)** | **W-7** Public Domain Software **Faber/Huang (RB)** | **W-8** ISO 9000 and Standards—XRF **Zaitz/Havrilla (BR)**<br>**W-9** Surface Analysis **Ebel/Ebel/Streli (TWI)** |
| **TUE. pm:** **Workshops** | | **W-10** Rietveld Analysis **Young/Bish (BR)**<br>**W-11** Polymer Data Analysis **Murthy (TWI)** | **W-12** Computational Method for XRF **Lachance/Criss (RB)**<br>**W-13** Specimen Preparation—XRF **Buhrke et al (SP)** |
| **TUE. eve.:** 6:30–8:30 **MDI and Rigaku/USA Reception** and **XRD Poster Session** (Chairs: Predecki/Snyder) Sponsored by: MDI & Rigaku/USA **(SP)** | | | |
| **WED. am.:** 8:30–12:00 noon **Plenary Session: "X-rays in Space"** Barton/Buhrke **(Upper Gondola Terminal)** | | | |
| **WED. pm:** **Sessions** | **C-1** Grazing Beam X-ray Analysis **Synder/Huang (BR)**<br>**C-2** Topography & Absorption Analysis **Stock/Ebel (SKY)** 1/4 day | **D-1** Applications of Diffraction to Pharmaceutical Analysis **Rendle/Stephenson (SKY)** 1/4 day<br>**D-2** Rietveld Applications I **Bish/Smith (SP)**<br>**D-3** Polymers I: Diffraction Studies of Industrial Polymer-Based Materials Platforms **Schwartz/Blanton (RB)** | **F-1** Applications of XRF to Industrial Problems **Jenkins/Hagopian-Babikian (TWI)** |
| | | | |
| **THURS. am:** **Sessions** | **C-3** Synchrotron Applications **Jordan-Sweet/O'Connor (BR)** | **D-4** Rietveld Applications II **Misture/McCarthy (SP)**<br>**D-5** Polymers II: In Situ Scattering/Diffraction Characterization of Polymers **Hsiao/Barton (RB)**<br>**D-6** Diffraction Stress Analysis I **Noyan/Sasaki (SKY)** | **F-2** Analysis of Thin Films by XRF **Wilson/Havrilla (TWI)**<br>**F-3** Mathematical Methods for XRF **Mantler/Criss (SUN)** |
| **THURS. pm:** **Sessions** | | **D-7** High Resolution XRD **Mooney/Kavanagh (SP)**<br>**D-8** Polymers III: Characterization of Complex Mesostructures Using Small Angle Scattering **Bunning/Vaia (RB)**<br>**D-9** Diffraction Stress Analysis II **Kämpfe/Hirose (BR)** | **F-4** TXRF: Semiconductor Applications, Micro/Chemical Applications, Instrumentation/Thin Films **Wobrauschek/Zaitz/Prange (TWI)** |
| **THURS. eve.:** 7:00 **Conference Dinner (SP)** | | | |
| **FRI. am:** **Sessions** | **C-4** Non-traditional Paradigms in Data Processing **Noyan/Wern (TWI)**<br>**C-5** X-ray Instrumentation & Other Applications **Berti/Broton (SP)** | | **F-5** Applications of XRF: Environmental Problems, Low Detection Limits **Gohshi/Dando (BR)** |

Meeting Rooms: SP = Sunshine Peak, BR = Buddy's Run, TWI = Twilight, RB = Rainbow, SKY = Skyline, SUN = Sunset
Any changes to program will be reflected in the Book of Abstracts.



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# 1999 Denver X-ray Conference Registration Form

Sheraton Steamboat Resort, 2–6 August 1999
Steamboat Springs, Colorado, U.S.A.

Please circle the workshops that you plan to attend:

W-1 W-2 W-3 W-4 W-5 W-6 W-7 W-8 W-9 W-10 W-11 W-12 W-13

The reduced registration fee will only be applied if **registration form and payment** are received on or before 14 July 1999.

| Registration Fees: | by July 14 | after July 14 |
|---|---|---|
| •Full week: exhibits, workshops, sessions† | $275 | $325 |
| •Monday & Tuesday: exhibits, workshops† | $225 | $275 |
| •Wed., Thurs. & Friday: exhibits, sessions† | $225 | $275 |
| •Invited speakers and workshop instructors† | $100 | $100 |
| •Students, unemployed X-ray people, and persons 65 and older‡: full week – exhibits, workshops, sessions | $50 | $50 |
| •Conference dinner, Thursday evening | $31 | $31 |

†Includes a copy of Volume 43 of ***Advances in X-ray Analysis*** on CD-ROM

‡Students and those unemployed must have their status confirmed by phone or letter to the Conference Coordinator (see information at bottom of page). Students registering at the conference are required to show I.D.

- ***Advances in X-ray Analysis***, Cumulative Volumes 1–39 on CD-ROM: $350
- ***Advances in X-ray Analysis***, Volumes 40 on CD-ROM: $150
- ***Powder Diffraction***✰ (Individual one year subscription): Domestic $60 / Overseas $85
- ***Powder Diffraction***✰ (Institution one year subscription): Worldwide $105

✰See further information regarding ***Powder Diffraction*** on page 2 of this program

Please print clearly to avoid errors on name tags and registration list.

Name ______________________________

Organization ______________________________

Address ______________________________

City ____________ State ____________ Zip ____________ Country ____________

Phone ____________ Fax ____________ E-mail ____________

**Payment:**

Total Amount Due: ____________ ❑ My payment is enclosed ❑ I will pay later at a higher rate

❑ Check enclosed for ____________ made payable to **ICDD/DXC**

❑ Charge my: ❑ Visa ❑ Mastercard ❑ American Express

Card number ______________________ Expiration date ____________

Signature ______________________________

Send registration form to: ICDD, Denise Flaherty, Conference Coordinator, 12 Campus Boulevard, Newtown Square, PA 19073-3273, U.S.A. E-mail dxc@icdd.com ◆ phone 610-325-9814 ◆ fax 610-325-9823

**Return by 14 July 1999**