

73rd Annual Denver X-ray Conference ReportStephanie Jennings 

ICDD, Newtown Square, PA, USA

Electronic mail: sjennings@icdd.com

I. FORMAT, DATES & ATTENDANCE

The 73rd Annual Conference on Applications of X-ray Analysis, more commonly known as the Denver X-ray Conference or DXC, was held on 5–9 August 2024. The weeklong conference returned to the Denver area, visiting The Westin Westminster, Westminster, Colorado, USA. X-ray and materials scientists gathered at the conference to discuss various techniques, applications, software, instruments, and products for XRD and XRF analysis. The combination of attendees and exhibitors brought the attendance to over 375 X-ray scientists, with over 25% from outside the United States.

II. DXC WORKSHOPS

The technical program began with 16 half-day tutorial workshops held on Monday and Tuesday of conference week. Topics were categorized as either XRD, XRF, or Special Topic and focused on both beginner and advanced levels. Thirty-seven specialists were invited to participate as workshop instructors, and many provided handouts that were posted on a private website for attendees only. Topics included:

Introduction to Machine Learning for X-ray Analysis – Part 1 & 2
 Machine Learning and Autonomous for X-ray Diffraction: An “Unconference” – Part 1 & 2
 Sample Preparation for XRD
 Non-ambient XRD
 Basic XRF
 Practical Microcomputed Tomography
 XRF of Layered Structures
 Quantitative XRF
 X-ray Sources and Optics
 Sample Preparation for XRF
 Micro XRF
 Stress Analysis
 2D Detectors
 XRF Trace Analysis

III. PLENARY SESSION AND DXC AWARDS

The Plenary Session, *Bio-Medical Imaging*, was held on Wednesday morning as the opening session for the oral talks that were presented during the next 3 days of conference week. **Scott Misture**, Alfred University, chaired the plenary, which began with an awards presentation.

The Birks Award, given biennially to recognize outstanding contributions to the field of X-ray spectrometry, was

presented to **Piero A. Pianetta** of Stanford University, USA. Dr. Pianetta received the award for his research using synchrotron radiation to develop ultra-sensitive Total Reflection X-ray Fluorescence methods to measure trace metallic impurities on the surfaces of silicon wafers. This analysis set new benchmarks for advanced semiconductor manufacturing, as well as launching the development of advanced TXRF instrumentation. Piero was not able to attend the conference, so he sent in a video acceptance speech that played during the Plenary Session.

Fourteen outstanding young scientists received the 2024 Robert L. Snyder Student Grant Award. The awardees and the works they presented at the conference were:

Md (Ashik) Ashikuzzaman, University of Massachusetts, Amherst, USA, *Comprehensive Analysis of Glauconite Sand: DCB Treatment Effects on Mineral Composition*, XRD Poster Session

Charles I. Ezekiel, The University of Iowa, USA, *Solid State Decolorization: Dismantling of an Orange-Red Zwitterionic Cocrystal by Multicomponent Milling*, XRD Poster Session

Lindsey Foote, Georgetown University, USA, *Solid State Desolvation of 5-Fluorocytosine Forms*, XRD Poster Session

Beau Herrington, Keele University, United Kingdom, *To Fix or Not to Fix: Deciphering Tissue Chemistry Through Multi-Model Analysis*, XRD Poster Session –and – *Exploring Prostate Cancer Biomarkers: Insights from Tissue Microenvironments and X-ray Scattering Analysis*, Bio-Medical Session

Zhao Jiang, University of Leeds, United Kingdom, *Revealing Calcium Carbonate Transformation Under In Situ Heating Using 4D Sparse Ptychographic X-ray Nanotomography*, Mining, Recycling, and Sustainable Materials Session

Patrick Kraus, Technical University of Vienna, Austria, *MAXI – Macro XRF Scanning Device with mm Spot Size for A4 Area Scans*, Micro XRF and Synchrotron Applications Session

Shae London, Georgetown University, USA, *Synthetic and Biogenic Ammonium Urates*, XRD Poster Session

Vinicius Pires Rezende, University of São Paulo, Brazil, *Strategies For In Vivo Diagnosis of Fertilizer Absorption and Transport in Plants by X-ray Fluorescence*, XRF Poster Session

Niklas Pyrlík, University of Hamburg, Germany, *Synchrotron-Based Multi-Modal Imaging Unveils Structure – Composition – Performance Correlations in CIGS Solar Cells*, XRD Poster Session



Monika Rasic, Loyola University Chicago, USA, *Analysis of Heavy Metals in White Grape Vinegar*, Trace Analysis Session

Michael Arkadi Romanov, DePaul University, USA, *Collagen Degradation Investigation in Archaeological Second Metacarpal Bones Using Synchrotron Wide-Angle X-ray Scattering*, XRD Poster Session

Hibiki Shirata, Meiji University, Japan, *Crystalline Phase Analysis of Cosmetic Foundation Using Powder X-ray Diffractometry*, XRD Poster Session

Kimberly Poppy Sinclair, University of Washington, USA, *Studying Aqueous Alteration on Mars Through Quantitative XRF from the Planetary Instrument for X-ray Lithochemistry*, Quantitative Analysis of XRF Session

Alyssa Tovar, Loyola University Chicago, USA, *Biomonitoring of Chicago's Pilsen and Little Village Industrial Corridors Using Daucus Carota*, Trace Analysis Session [Figure 1](#).

Following the awards presentation, the plenary session continued with three captivating talks by keynote speakers **Stuart Stock**, Northwestern University, USA, **Olga Antipova**, Argonne National Laboratory, USA, and **Andrew Nelson**, University of Western Ontario, Canada. Dr. Stock presented the talk, *Beyond Jaws: The Mineralized Cartilage of Shark Vertebral Centra*. Next was Dr. Antipova's presentation on *X-ray Fluorescence Microscopy Brightens up Biological and Medical Research*. Lastly, Dr. Nelson presented on *Paleobiomedical Imaging: The Use of X-ray and CT to Study Egyptian and Peruvian Mummies*. The session was very well attended and offered great insight into future advancements in science and technology ([Figure 2](#)).

IV. SPECIAL SESSIONS

From Wednesday afternoon through Friday morning, 17 half-day oral sessions were held. Over 100 presentations were organized in the oral sessions, with over 30 presentations given by invited speakers and experts in their respective fields. Topics included:

New Developments in XRD & XRF Instrumentation
Stress and Texture Analysis
Rietveld and PDF Applications
Quantitative Analysis of XRF
Mining, Recycling, and Sustainable Materials
General XRD – Parts 1 & 2
Cultural Heritage
Trace Analysis
Micro XRF and Synchrotron Applications
Bio-Medical
Non-ambient Measurements
General XRF
Machine Learning Techniques in X-ray Analysis
Energy Materials Characterization
Industrial Applications of XRD
Industrial Applications of XRF

V. POSTER SESSIONS

Posters were presented on Monday and Tuesday evenings during the XRD and XRF poster sessions. Attendees were allowed to preview electronic copies of the posters through the mobile app, Whova. The respected judges chose the best posters, and the competition was strong ([Figure 3](#)).

Ultimately, the following presenters were named winners:



Figure 1. 2024 Robert L. Snyder student grant award winners.



Figure 2. Plenary Speakers (L–R) – Scott Mixture (Session Chair), Andrew Nelson, Olga Antipova, and Stuart Stock.

XRD Best Poster Awards:

Hibiki Shirata*, **Y. Koike**, Meiji University, Japan
A. Ohbuchi, Rigaku Corporation, Japan, for their work:
Crystalline Phase Analysis of Cosmetic Foundation Using Powder X-ray Diffractometry

Sarah Gosling*, **M. Kitchen**, **C. Greenwood**, Keele University, United Kingdom

E. Arnold, **T. Geraki**, **T. Snow**, Diamond Light Source, United Kingdom

P. Cool, The Robert Jones and Agnes Hunt Orthopaedic School, United Kingdom

K. Rogers, Cranfield University, United Kingdom

I. Lyburn, Thirlestaine Breast Centre, Gloucestershire Hospitals NHS Foundation Trust, United Kingdom

N. Stone, University of Exeter, United Kingdom, for their work:

A Novel Cancer Biomarker – Unveiling the Role of Microcalcifications in the Prostate

Niklas Pyrlík*, **C. Ossig**, **J. Hense**, **C. Ziska**, German Electron Synchrotron (DESY) and Universität Hamburg, Germany

S. Patjens, **G. Fevola**, **M. Seyrich**, **F. Seiboth**, **A. Schropp**, **J. Garrevoet**, **G. Falkenberg**, **C.G. Schroer**, **M.E. Stuckelberger**, German Electron Synchrotron (DESY), Germany

R. Carron, Swiss Federal Laboratories for Materials Science and Technology Empa, Switzerland, for their work:

Synchrotron-Based Multi-Modal Imaging Unveils Structure – Composition – Performance Correlations in CIGS Solar Cells

Best XRD Student Poster:

Adarsh Kabekkodu*, Downingtown East High School, USA

M. Rost, ICDD, USA, for their work:

Qualitative Phase Analysis of Brand Name Vs Generic Drugs (Antacids and Acid Reducers) Using Powder X-ray Diffraction (Figure 4).

XRF Best Poster Award:

Anik Chowdhury*, DuPont, USA

L. Brehm, Retired, Dow, USA, for their work:

Comparative Elemental Analysis Study of Polyurethane Adhesive Products Using X-ray Fluorescence Spectrometers with Different Configurations

We would like to thank three of our exhibitors for sponsoring additional Best Poster Awards during the XRF Poster Session, Amptek, Inc., Moxtek, Inc., and XOS.

Amptek Award for Best Student XRF Poster:

Benard Patawah*, Illinois Institute of Technology, USA, for their work:

XAS Study of the Local Atomic Environment of Fe K-Edge In Fe₂O₃:Bi Nanoparticle as Anode for Oxide-Air Battery Application

Moxtek Scientific Merit Award:

Sebastian Hauser*, **J. Karletshofer**, **K. Leopold**, Ulm University, Germany, for their work:

Evaluation of Different Sample Preparation for Trace Elements in Biological Samples – Performance and Greenness

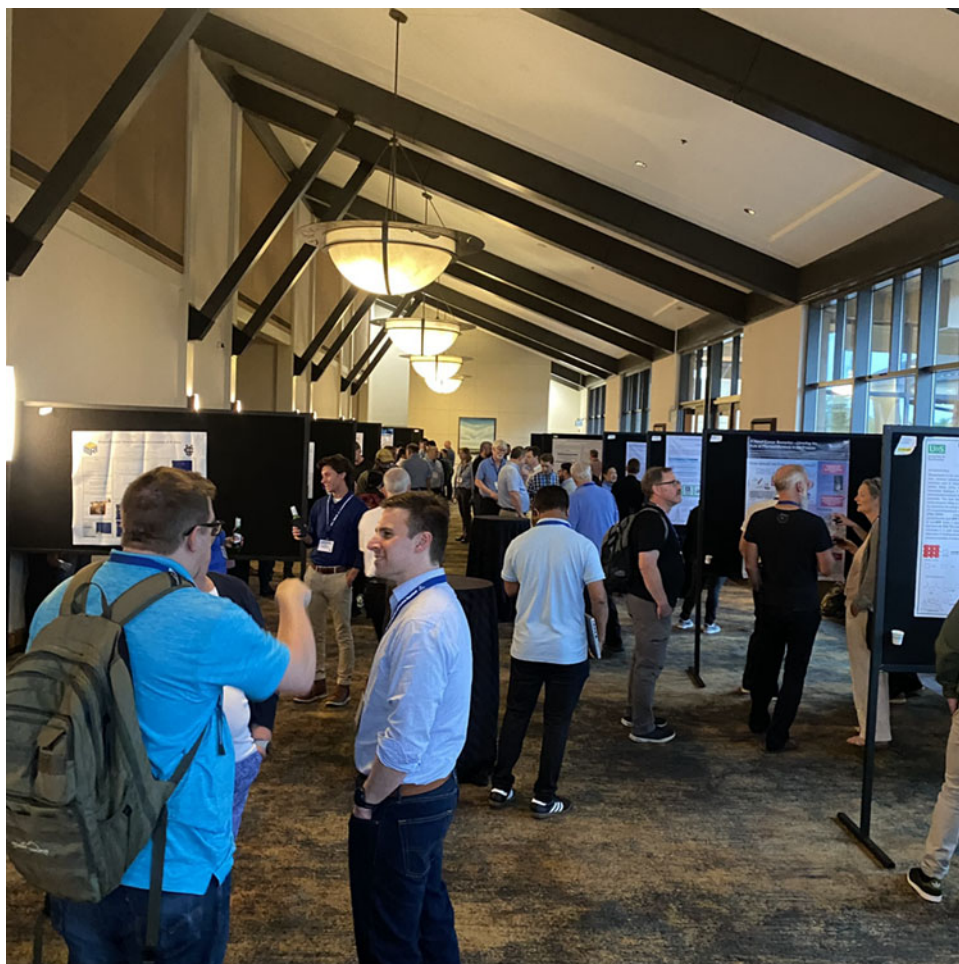


Figure 3. XRD poster session.



Figure 4. XRD Poster Session Award Winners (L–R) – Tom Watkins (Poster Judge), Niklas Pyrlik, Hibiki Shirata, Sarah Gosling, and Adarsh Kabekkodu.



Figure 5. XRF Poster Session Award Winners (L–R) – Michael Wojcik, Sebastian Hauser, Dan Paas (Poster Judge), Helen Muccitelli (Poster Judge), Mark Samways (Poster Judge), Benard Patawah, Andrew Crawford, Diane Eichert (Poster Judge), Martina Schmeling (Poster Judge), and Anik Chowdhury.

XOS Innovation Award™:

1st Place:

Andrew M. Crawford*, Michigan State University, Argonne National Laboratory, and Northwestern University, USA

A. Glowacki, E. Maxey, S. Chen, O. Antipova, Argonne National Laboratory, USA

Y. Chen, J. Balough, Q. Jin, C. Jacobsen, Northwestern University, USA

J.E. Penner-Hahn, University of Michigan, USA

K. MacRenaris, T.K. Woodruff, T.V. O'Halloran, Michigan State University, for their work:

Dwell Time Specific Quantitation Errors Associated with Using Per-Pixel Baseline Correction on X-ray Fluorescence

Runner Up:

Michael Wojcik*, **R. Conley, L. Assoufid**, Argonne National Laboratory, USA, for their work:

Development of High-Resolution Zone Plates for X-ray Fluorescence Experiments at the Advanced Photon Source (Figure 5).

VI. EXHIBITS AND SPONSORSHIPS

The exhibit hall accommodated 30 companies with displays of products and services for the X-ray community. See a complete listing of exhibitors and their product descriptions in the 2024 Onsite Program located at www.dxcicdd.com. The Denver X-ray Conference is very appreciative of their support this year.

Many of the exhibitors also supported the conference as sponsors, including Amptek, Inc., Anton Paar, Bruker, Fenno-Aurum Oy, ICDD, KETEK GmbH, Materials Data,

Moxtek, Inc., Petrick GmbH, PREMIER Lab Supply, Proto Manufacturing, Rigaku Americas, and XOS. The generosity of our sponsors helps to keep attendee costs low and the quality of the conference high. We are grateful for their support!

VII. WEBSITE AND PROCEEDINGS

To view the complete DXC Program, please visit the “Past DXC” page of the conference website, located under the “About DXC” tab at www.dxcicdd.com. The conference proceedings, *Advances in X-ray Analysis*, Volume 68, will be published in the summer of 2025. Select papers will also be published in *Powder Diffraction Journal*. Please also visit the “Resources” tab on the ICDD website www.icdd.com for free full access to manuscripts published in Volumes 40 through 67 of *Advances in X-ray Analysis*.

VIII. THANK YOU

The Conference Services team at ICDD would like to thank the many people who volunteered their time and efforts to organize this event. Members of the DXC Organizing Committee, Session Chairs, Workshop Instructors, Invited and Contributed Speakers, and Exhibitors all played a role in bringing the community together. Special thanks to the attendees who joined us as well. The success of the event is attributed to each and every individual who participated, and we send our genuine thanks to all of you!

IX. 2025 MEETING

Save the date! In 2025, DXC will return to Maryland, 4-8 August, at The Bethesda North Marriott Hotel & Conference Center, Rockville, Maryland, USA. Located right outside of Washington D.C. with easy access to the Washington Metro.