Newsletter

Integrated CoreTech

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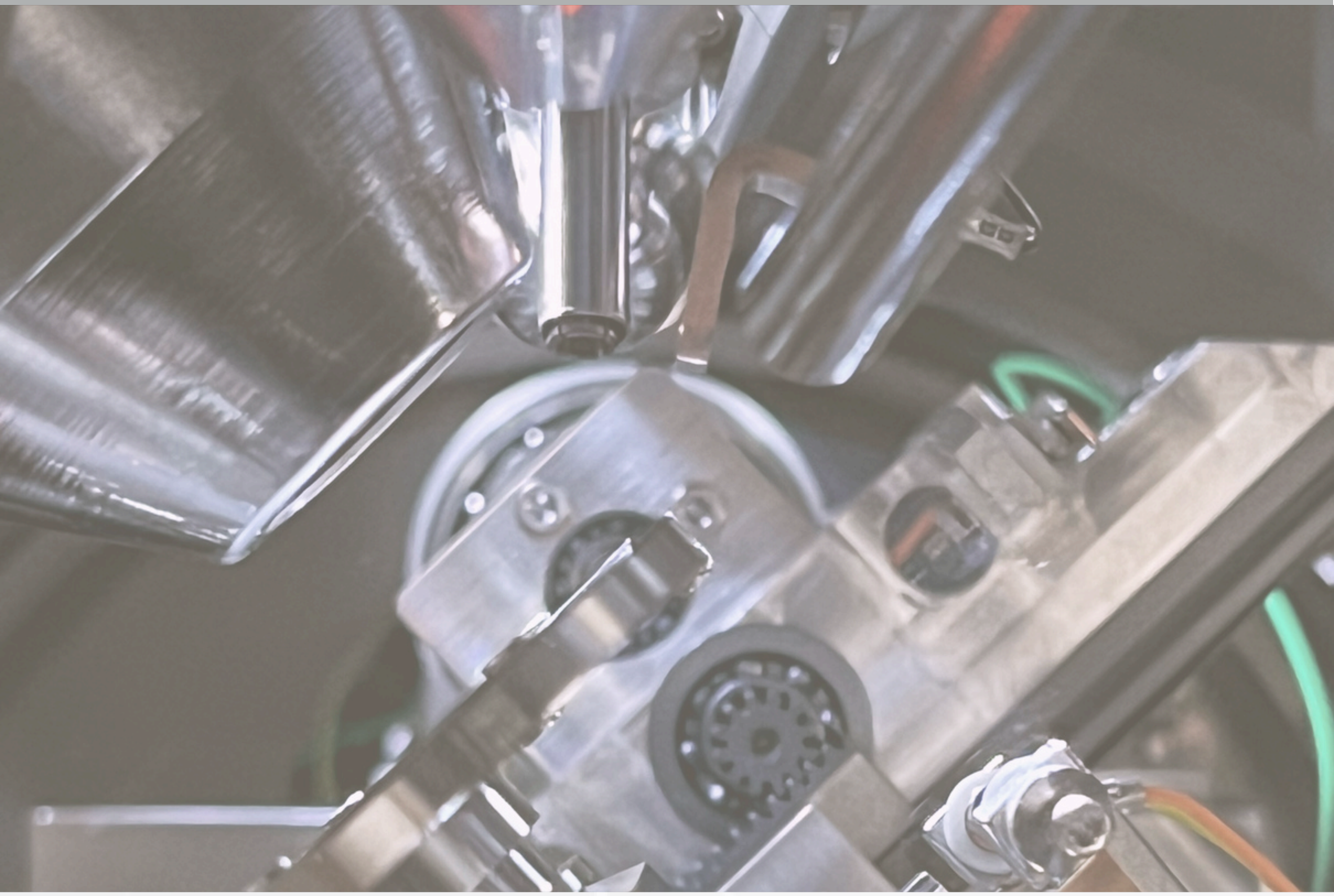
Issue 003, Mar 2025



Revolutionize Your Analysis: Introducing Non-Destructive Depth-Profiling Software!

Explore how this tool transforms multi-layered thin film analysis.

Meet the Experts at Our Upcoming User Meeting!

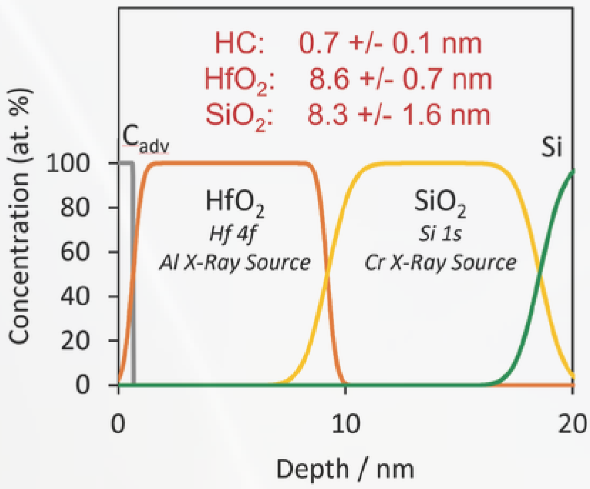
Dive into the biographies of our distinguished panelists.

StrataPHI 2.0

StrataPHI 2.0 is a non-destructive depth-profiling software designed to analyze the structure of multi-layered thin films, ranging from a monolayer up to ~30 nm in thickness. By leveraging angle-dependent XPS (X-ray Photoelectron Spectroscopy) and HAXPES (Hard X-ray Photoelectron Spectroscopy) spectral data, it provides precise structural insights.

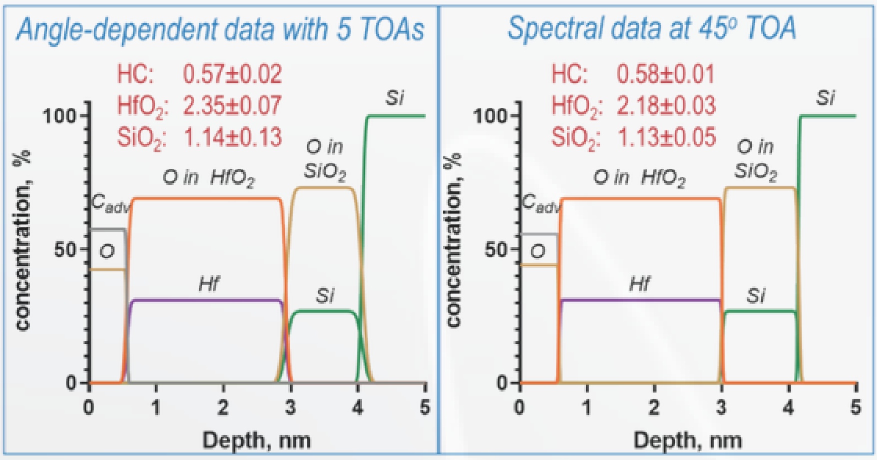
StrataPHI 2.0 offers a suite of advanced capabilities designed to streamline and enhance thin film analysis:

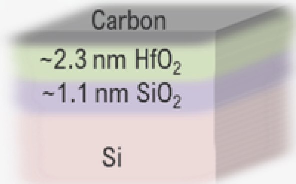
- It **accurately** calculates the thickness of discrete-layer thin films, ensuring precise structural insights.
- NEW By **combining angle-dependent XPS and HAXPES data**, it amplifies signals from layers at varying depths, enabling comprehensive depth profiling.
- NEW A new **fractional coverage** feature allows for precise calculation of surface coverage, adding another layer of detail to your analysis.
- NEW The software's simulation mode identifies the **optimal Al/Cr X-ray transitions** for specific multi-layer stacks, optimizing data acquisition.
- Additionally, for multi-layer samples with distinct chemistry in each layer, StrataPHI 2.0 simplifies the process by deriving thickness from spectral data measured at a **single take-off angle (TOA)**, making it both efficient and user-friendly.



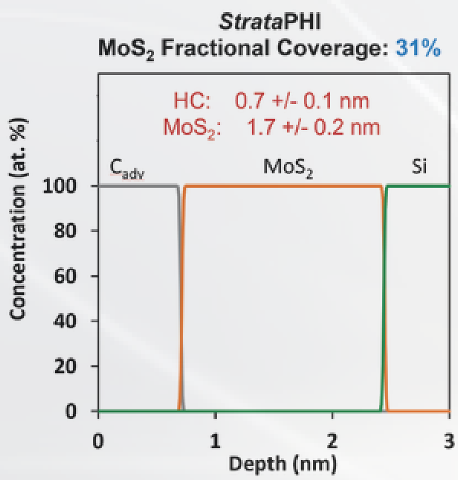
Thickness of thicker layers can be accurately obtained from **combined angle-resolved XPS and HAXPES data** in a single StrataPHI analysis of 8.2 nm HfO2/8 nm SiO2 on Si substrate. Si 1s transition from Cr X-ray source from tens of nanometers below the surface and Hf 4f transition from Al X-ray source closer to the sample surface are combined for structure estimation.

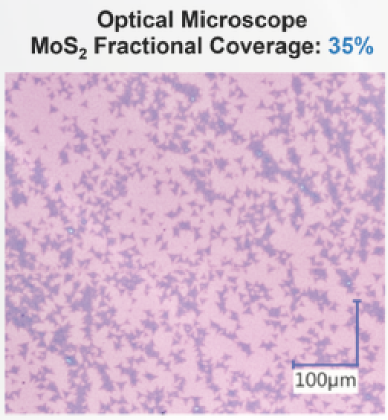
StrataPHI 2.0





Thickness of 3-layered system obtained from an angle-dependent dataset and from a single TOA. High accuracy of thicknesses can be extracted **from a single TOA** measurement.





StrataPHI allows calculation of **fractional coverage**. Thickness and coverage of partially-covered MoS2 flakes were calculated from multiple take-off angles in StrataPHI 2.0. Calculated coverage is very close to that determined with an optical microscope.

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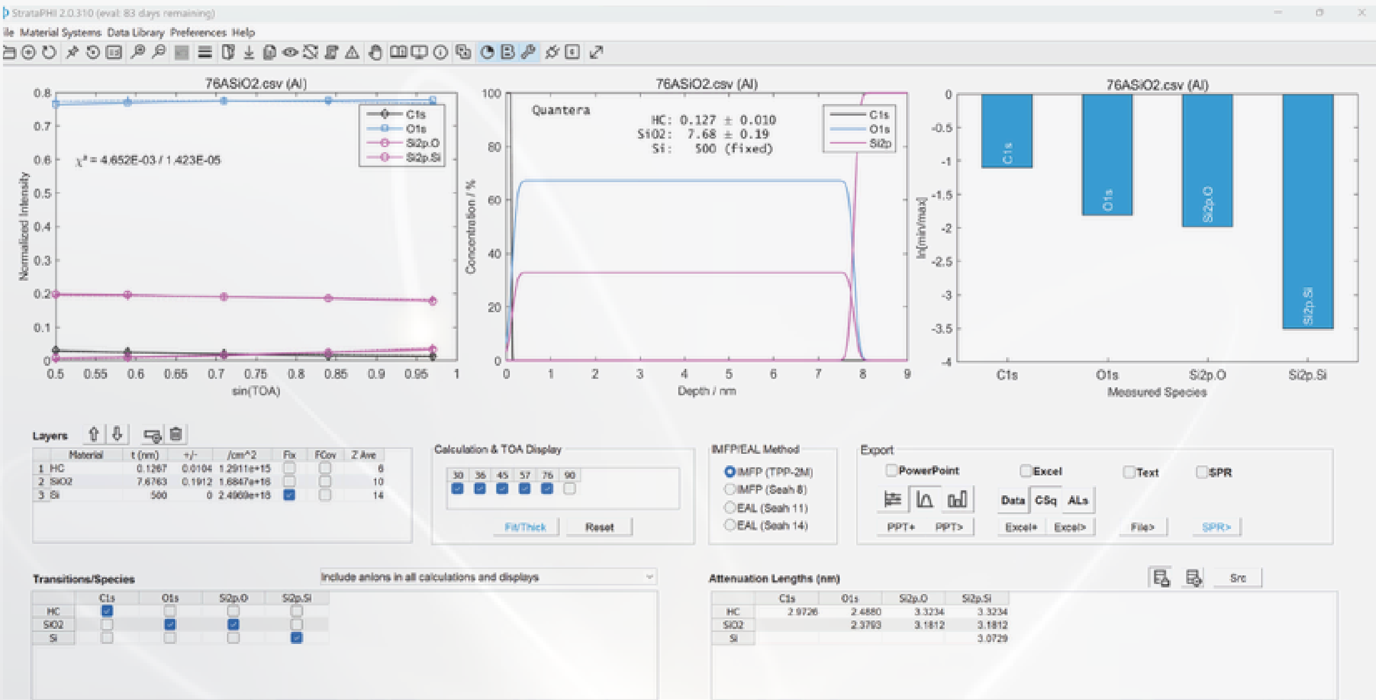

Applications and Features:

- Non-destructive multi-layer thin film thickness and composition. (depth profile)
- High-throughput metrology tool - automated data file handling and calculations.
- Surface coverage in atoms/cm2 from XPS and HAXPES data.
- Adventitious carbon thickness.
- Combines XPS and HAXPES spectra in a single analysis for thickness of layers of various thicknesses.
- Built-in database editor for material properties and attenuation lengths. (ALs)
- User-defined recipes can be saved and invoked for consistent treatment of multiple data sets for metrology and other applications.
- StrataPHI processing recording (SPR) file tracks model setup and saves optimized structure for future analysis and sharing among users.
- Automated logging capability with export to Excel™, PowerPoint™, text files, and processing record files.
- Very fast calculation - less than 0.2 seconds.
- Works with data from **all Physical Electronics XPS instruments**.
- Creates ANG and PRO files from individual SPE files.

Surface Science Technology Workshop,

co-organized by

Institute of Materials Research and Engineering (IMRE) and

CoreTech Integrated Limited.

Date: March 28, 2025

Institute of Materials Research and Engineering

A*STAR IMRE

Integrated CoreTech

Resgister now to secure your seat!

SPEAKER BIOGRAPHY

Prof. Somin, PARK
Talk: Nanoscale Surface Chemistry for Energy Technologies

We are thrilled to welcome **Prof. Somin PARK**, an accomplished researcher and Assistant Professor of Chemistry at the National University of Singapore, to this year's seminar. With over a decade of experience in materials science and surface chemistry, Prof. Park has established herself as a leading voice in the field of advanced materials and sustainable energy applications.

Prof. Park's impressive academic journey includes a **PhD in Materials Science and Engineering** from the University of Kentucky and postdoctoral fellowships at Northwestern University and the University of Toronto, where she worked under the guidance of renowned experts. Her groundbreaking research has been published in top-tier journals such as **Nature**, **Science**, and the **Journal of the American Chemical Society**, with over 40 publications and more than 3,500 citations to her name. Notably, her work on low-loss contacts for inverted perovskite solar cells was featured in Nature in 2023, earning widespread recognition in the scientific community.

In addition to her research, Prof. Park has been honored with numerous awards, including the **American Chemical Society (ACS) Physical Chemistry Young Investigator Award** and recognition as a **Rising Star in Materials Science and Engineering** by Stanford, MIT, and Carnegie Mellon University. She was also awarded the prestigious **Presidential Young Professorship** at the National University of Singapore in 2024.

Beyond her professional achievements, Prof. Park is passionate about exploring new cultures and cities, particularly in her current home of Singapore. Her adventurous spirit and dedication to advancing sustainable energy solutions make her a truly inspiring figure in the scientific community.

SPEAKER BIOGRAPHY

ULVAC-PHI, INC.

Dr. Hsun-Yun, CHANG

Talk: Surface Analysis Using Multi-technic XPS System

We are delighted to welcome **Dr. Hsun-Yun CHANG**, a distinguished researcher with extensive expertise in surface analysis and advanced materials, to this year's seminar. Dr. Chang's work focuses on the application of cutting-edge techniques such as **Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS)**, **X-ray Photoelectron Spectroscopy (XPS)**, and **CrKa Hard X-ray Photoelectron Spectrocopy (HAXPES)** to study a wide range of materials, including biological samples, OLEDs, and solar cell devices.

Dr. Chang earned her **PhD** through the **Taiwan International Graduate Program**, a collaboration between Academia Sinica and National Tsing Hua University. Her doctoral research laid the foundation for her deep understanding of surface characterization, which she has since applied to innovative projects in collaboration with leading institutions such as **National Taiwan University**, **Case Western Reserve University**, and **National Tsing Hua University**.

After completing her PhD, Dr. Chang continued her research as a postdoctoral fellow at **Academia Sinica** before joining **ULVAC-PHI** in Japan. There, she led research on surface analysis techniques, managed demonstrations, and trained professionals in the use of ToF-SIMS and XPS. Her current research interests include novel all-solid-state batteries, high-entropy alloys, and perovskite solar cells, where her work is driving advancements in energy storage and sustainable technologies.

SPEAKER BIOGRAPHY

Professor Jing-Jong, SHYUE

Talk: Common Issues in XPS Analysis. Identifying and Mitigating Them.

Professor Jing-Jong Shyue is a distinguished researcher and academic with a remarkable career in materials science and engineering. He began his journey as a **silver medalist at the 25th International Chemistry Olympiad in 1993**, showcasing his early talent in chemistry. He earned his B.S. degree from the Department of Chemistry at National Taiwan University in 1997. After completing two years of mandatory military service at the National Defense Medical Center, he pursued advanced studies in the **Department of Materials Science and Engineering at Case Western Reserve University**, where he obtained his **M.S. in 2002 and Ph.D. in 2004**.

Currently, Professor Shyue serves as a **Research Fellow** at the **Research Center for Applied Sciences in Academia Sinica** and as a **Professor in the Department of Materials Science and Engineering at National Taiwan University**. His research focuses on surface and interface sciences, exploring areas such as the effect of surface properties on cell adhesion processes, molecular transportation, and the characterization of organic-inorganic hybrid materials and biological specimens using advanced techniques like **XPS (X-ray Photoelectron Spectroscopy)** and **ToF-SIMS (Time-of-Flight Secondary Ion Mass Spectrometry)** with cluster ion beams.

With over 200 published papers and more than 6,000 citations, Professor Shyue has made significant contributions to his field. He also serves as a **co-editor** for the **Journal of Colloid and Interface Science**, further solidifying his role as a leader in the scientific community.

SPEAKER BIOGRAPHY

Dr. Ji Rong
Talk: Surface Analysis Applications at IMRE.

Dr. Ji Rong is a **Deputy Department Head** and **Senior Principal Scientist** at the **Institute of Materials Research and Engineering (IMRE)**, A*STAR, with over 20 years of experience in material characterization and failure analysis. Dr. Ji specializes in techniques such as **Auger Electron Spectroscopy (AES), X-ray Photoelectron Spectroscopy (XPS), and Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS)**. She has led numerous projects in material characterization and failure analysis, collaborating with advanced systems like the PHI SMART-200, PHI Quantum 2000, and PHI Trift II TOF-SIMS. Dr. Ji's extensive expertise and leadership have made her a respected figure in the field of advanced materials research.

SPEAKER BIOGRAPHY

Institute of Sustainability for Chemicals, Energy and Environment
A*STAR ISCE²

Dr. Tan Mingwu & Ms. April Wang Zhan
Talk: Overview of the XPS System in JI ISCE2 and
In-Situ XPS Applications in Heterogeneous Catalysis.

Dr. Tan Mingwu is a **Senior Scientist** with a **PhD in Physical Chemistry** and over 9 years of experience in the field of heterogeneous catalysis. His expertise lies in catalyst design, catalyst characterization, reaction mechanisms, and kinetics. Dr. Tan has led projects with total funding exceeding 2 million SGD and has published nearly 40 articles in top-tier journals, including **Nature Communications** and **Angewandte Chemie**. He has also chaired symposiums at three international conferences and was honored with the **ISCE2 Best Mentor Award** for his outstanding mentorship. Dr. Tan's work continues to push the boundaries of catalysis research, making significant contributions to the scientific community.

Ms. April Wang Zhan is a **Lead Research Engineer** with over 15 years of experience in surface characterization of catalysts using **X-ray Photoelectron Spectroscopy (XPS)**. She has collaborated on advanced projects, including work with the Thermo VG ESCALAB250 XPS system. Ms. Wang's expertise in surface analysis has been instrumental in advancing research in catalyst characterization. Her dedication to precision and innovation has made her a key contributor to her field, and she continues to play a vital role in cutting-edge research and development.