JP Analytical is a precision thin-film metrology and semiconductor R&D partner delivering quantitative, physics-based insight into advanced materials and devices. Through specialized characterization, defect passivation, thermal processing, and tailored research programs, we help innovators move from complex materials challenges to scalable technology with confidence. The technical staff comprises ion bean materials modification and analysis experts with more than 20 years of experience (see 2nd page).

SURFACE METHODS

UV H^+/D^+ cleaning
XPS
AFM
HFS

DEPTH METHODS

Ion Beam Analysis
RBS PIXE NRA
HFS
PALS
SIMS

ELEMENTAL

Ion Beam Analysis
RBS PIXE HFS
NRA PIGE
XPS
XRF

CHEMICAL

XPS
IBIL
XRD

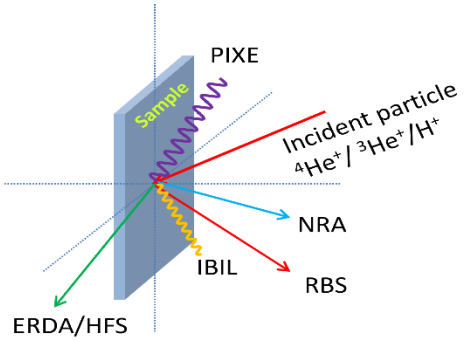
DEFECT/TOPOGRAPHY

Ion Beam (ERD / RBS Channeling)
PALS
AFM
Hydrogenation

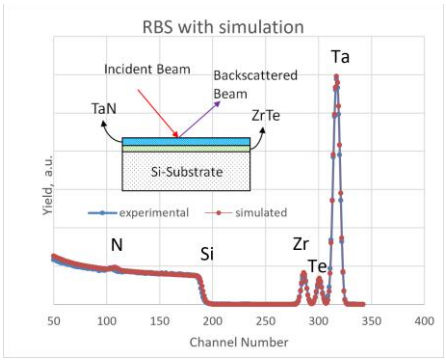
Our expert scientists can provide analytical solutions to help solve your materials development challenges.

info@jpanalytical.com

Materials Analysis and Modification



IBA Scattering Events: Analysis does not require a standard for quantification and is mostly matrix-independent and non-destructive.



Thin Film Stoichometry and Thickness Analysis			
Ti:N	TiN Thickness	Zr:Te	ZrTe Thickness
44:56	25 nm	68:32	14 nm

- **Ion Beam Analysis**—A suite of analyses (noted in diagram at left) can be performed simultaneously to span the Periodic Table.
  - **RBS**: Sensitivity increases with atomic number.
  - **ERDA**/Forward Scattering: For direct analysis of H in near surface region.
  - **NRA**: Nuclear reaction for particle (p,α) and gamma (γ) emission for light element analysis.
  - **PIXE**: MeV ion/proton to excite characteristic X-ray emission.
  - **IBIL**: Ion beam induced visible light emission (luminescence) provides insight into chemical bonds.
- **XPS**—Photoelectron spectroscopy, driven by x-rays or keV electrons, for surface elemental and chemical analysis.
- **PALS**—Positron Annihilation Lifetime Spectroscopy for vacancy concentration and size distribution.
- **XRF**—X-ray Fluorescence is a trace element analysis technique using a Ag anode X-ray beam to excite the sample surface.
- **AFM**—Scanning probe microscopy surface topography analysis with nm resolution for surface engineering process development.
- **SIMS**—Secondary Ion Mass Spectrometry (SIMS) is one of the most sensitive analytical techniques available for elemental analysis of thin films and semiconductor materials.

Advanced Materials Research and R&D Partnership

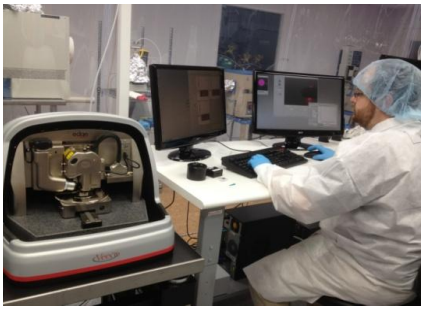
- **Defect Mitigation:** JPA's controlled atmosphere (low and high-pressure) hydrogenation offers growth- and process-related defect passivation. In-diffused hydrogen reacts with defects and eliminates (passivates) defect states deep within the band gap.

  Deuterium is used instead of protium due to more stable bonding and ease of characterization.

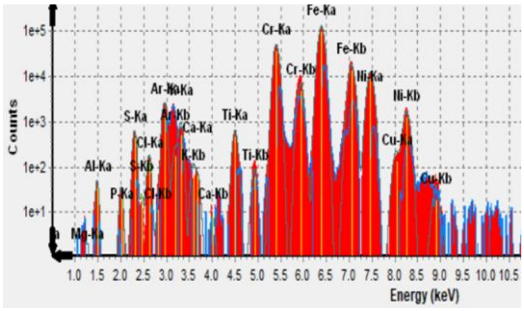
- **R&D Partnerships:** Modifications—Low energy ion irradiation; surface cleaning with atomic hydrogen; Rapid Thermal Processing to assist materials research.

JP ANALYTICAL

Our Expertise and Quality Methods



AFM imaging with scanning probe microscopy



XRF Spectra identifying heavy elements in a C-based substrate

JP Analytical employs highly trained personnel and utilizes inter-laboratory comparisons, calibration samples, process monitoring, and standardized process records to ensure that high-quality work is performed and fully reported. Our research team includes experienced PIs that have been awarded DOE and DOD grants and contracts for analytical toolset development and materials/device operability enhancement.

* Example publications:

Characterizations of extrinsically doped CZTS thin films for solar cell absorbers fabricated by sol-gel spin coating method, A. K. S. Gupta, **K. Hossain**, *et. al., Appl. Surf. Sci. Adv. 13 (2023) 100352*

Impact of Hydrogenation on the minority carrier lifetime of InAsSbBi and the sensitivity of InAsSbBi nBn photodetectors, M.R. Michaels, **M.S. Dhoubhadel, K. Hossain**, A.W. Duchane, R.A. Carrasco, L. Helms, C. Hains, J.V. Logan, A.M. McMinn, C.P. Morath, D. Maestas, and PT. Webster, J. App. Phys. 137 (2025) 235701

Recent Customer Areas and Needs…

- R&D—RBS of thin films; NRA for B-dopant concentration in Si wafer
- Thin film growth by ALD, PVD, CVD, MOCVD – RBS/XRF/XPS/SIMS for thin film stoichiometry, hydrogen depth proviling
- Microelectronics—RBS for stoichiometry and depth profiling of thin films on wafers
- Vacuum deposition equipment—RBS/PIXE and forward scattering for thin film qualification/calibration
- Infrared sensors—Hydrogen cleaning of wafers for epitaxy; XPS of surface cleanliness; RBS for hetero-structure profile

SERVICES AVAILABLE

Advanced Materials

- Composition Analysis
- Micro/nano Structure
- Surface Analysis
- Defect Passivation

Manufacturing Support

- Process Control
- Failure Analysis
- Raw materials Qualification

JP ANALYTICAL

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