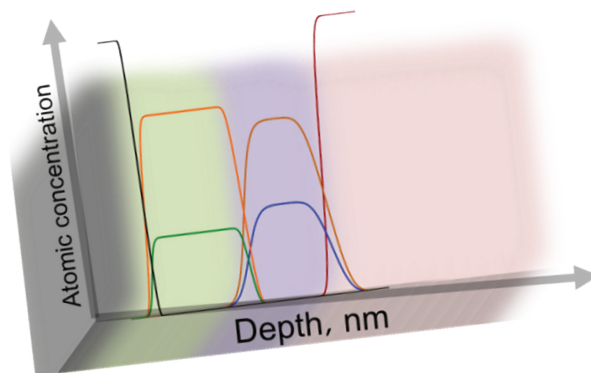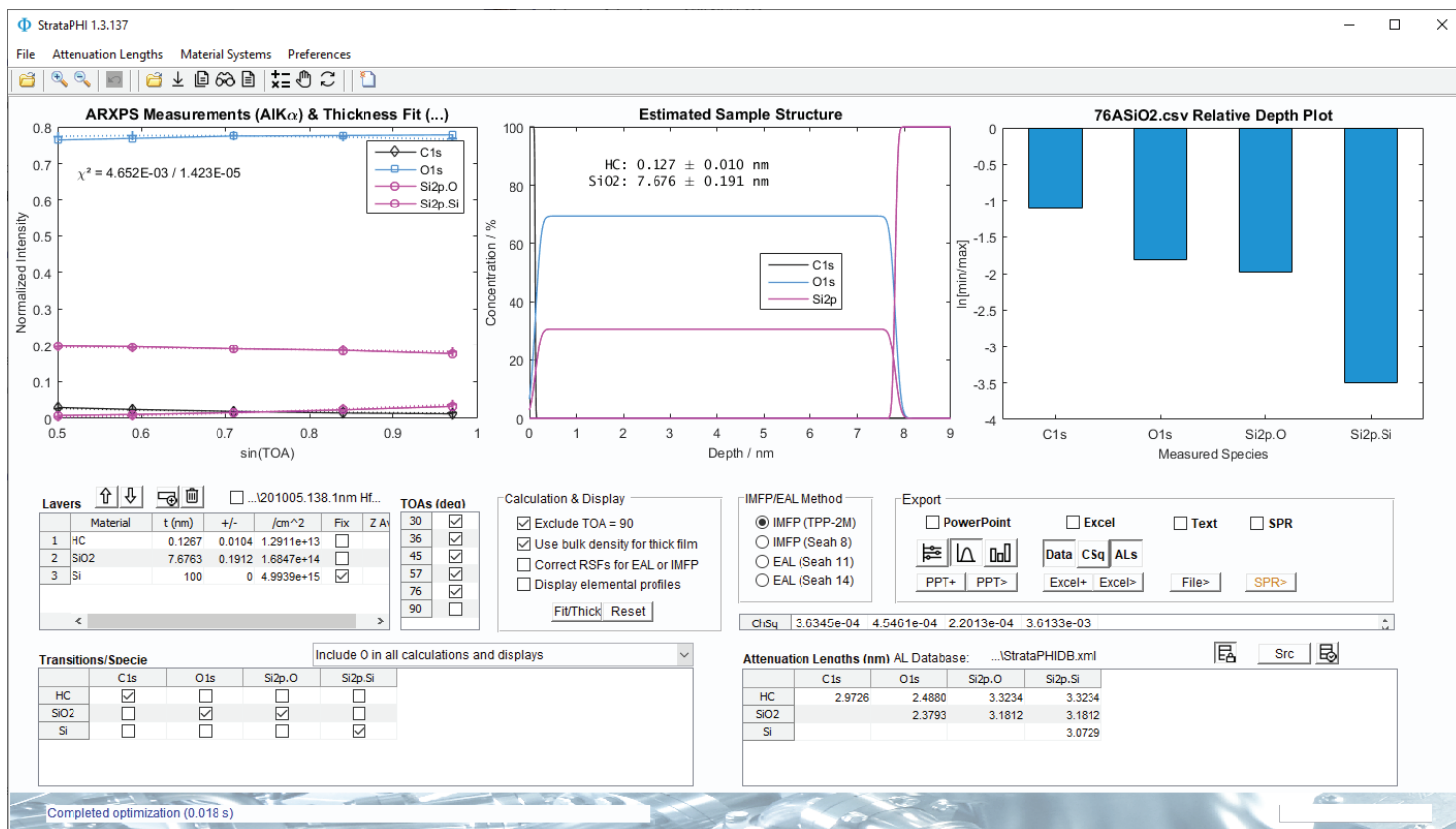# StrataPHI

Thin Film Structure Analysis

Highlights

- *Strata*PHI is software for estimating the structure of thin film stacks from spectral and angle-dependent XPS and HAXPES data.
- *Strata*PHI calculates thickness for thin film structures composed of discrete layers.
- For multi-layer samples with unique chemistry in each layer, thickness can be calculated from spectral data measured at a single take-off angle (TOA).
- Material database of calculated and user-created IMFPs and EAL parameters.
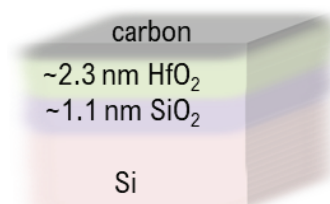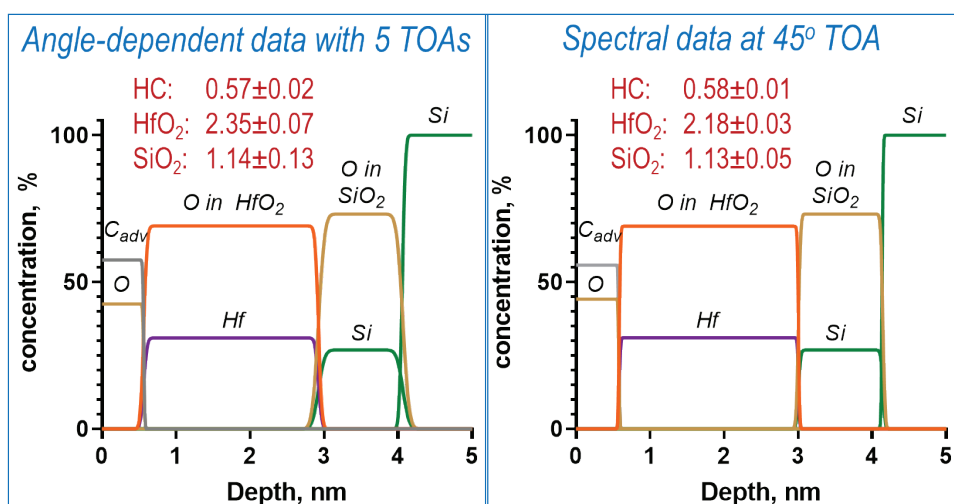- Automated output to popular reporting formats.

Applications

- Multi-layer thin film thickness
- Adventitious carbon thickness
- Surface Coverage (atoms/cm^2)
- High-throughput metrology tool for thin film structures

*Strata*PHI

- Calculates thickness in nm and coverage in atoms/cm^2 from XPS and HAXPES data
- Calculates concentration depth profile
- Estimate thickness uncertainties
- Built-in database editor for material properties and attenuation lengths (ALs) using common calculation methods for IMFP and EAL for multiple X-ray sources
- User-defined material system recipes can be saved and invoked for consistent treatment of multiple data sets for metrology and other applications
- Smart Process Record tracks model setup and saves optimized structure for future analysis and sharing among users
- Automated data file handling and calculations for high throughput
- Automated logging capability with export to Excel™, PowerPoint™, text files and processing record files
- Very fast calculation - less than 0.2 seconds
- Works for data from all PHI XPS instruments
- Creates ANG and PRO files from individual SPE files

Angle-dependent data with 5 TOAs

HC: 0.57±0.02
HfO$_2$: 2.35±0.07
SiO$_2$: 1.14±0.13

Spectral data at 45° TOA

HC: 0.58±0.01
HfO$_2$: 2.18±0.03
SiO$_2$: 1.13±0.05

carbon
~2.3 nm HfO$_2$
~1.1 nm SiO$_2$
Si

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

Angle-dependent HAXPES data

HC: 2.05±0.41
TiN: 10.76±0.98
HfO$_2$: 1.11±0.32

HC
10 nm TiN
1 nm HfO$_2$
Si
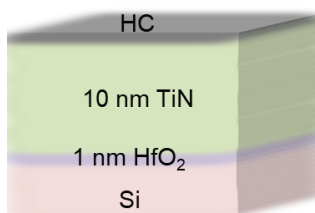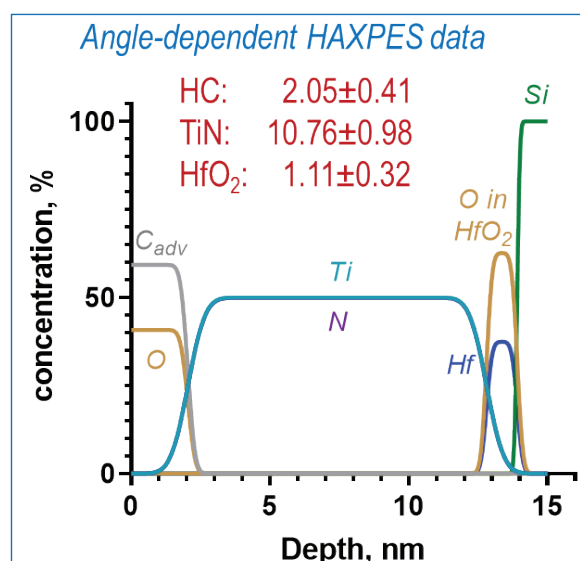
Thickness of thicker layers can be accurately obtained from angle-dependent HAXPES data. Cr X-ray source gives access to Hf 3d avoiding overlap between Hf 4f and N 2s transitions. Accurate quantification for all layers is obtained by using experimental RSF quantification parameters.

PHYSICAL ELECTRONICS
A DIVISION OF ULVAC-PHI