

SEMILAB uSE-2300

New generation of ellipsometer to address 4-8" fab needs

Semilab Semiconductor Physics Laboratory Co. Ltd.

AGENDA

- SEMILAB product mix and uSE-2300
- 40 years of ellipsometry history
- uSE-2300 – Addressing 8” fab requirement
- uSE-2300 – The tool
- uSE-2300 – The metrology
- uSE-2300 – Fab deployment (key benefits)
- CONCLUSION

Semilab - Global company with European HQ



1990: Founding → 2004-2010: Photovoltaic era → 2008-2023: Flat panel era → 2004-2023: Semiconductor era

Semilab metrology solutions for semiconductor industry



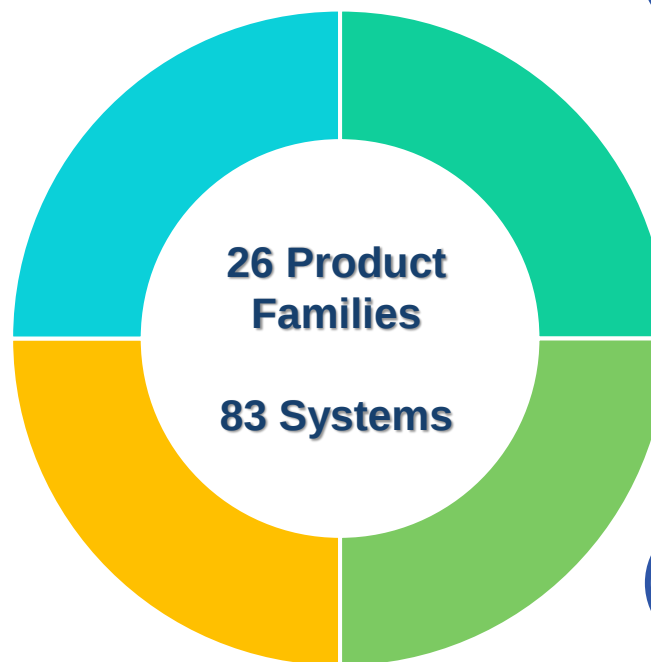
Optical Metrologies and Inspection

- **Enhanced Infrared Reflectometry**
- **Light Scattering Tomography**
- **Photoluminescence Imaging**
- Photomodulated Reflectometry
- Polarized Stress Imaging
- Porosimetry
- **Spectroscopic Ellipsometry**
- Spectral Photoluminescence



Scanning Probe Microscopy

- Atomic Force Microscopy



Non-Contact Electrical Metrologies

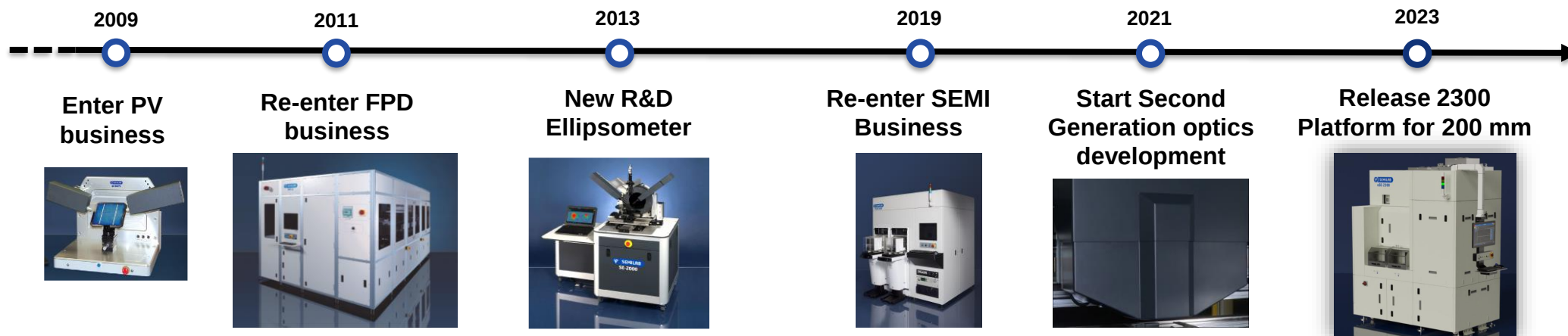
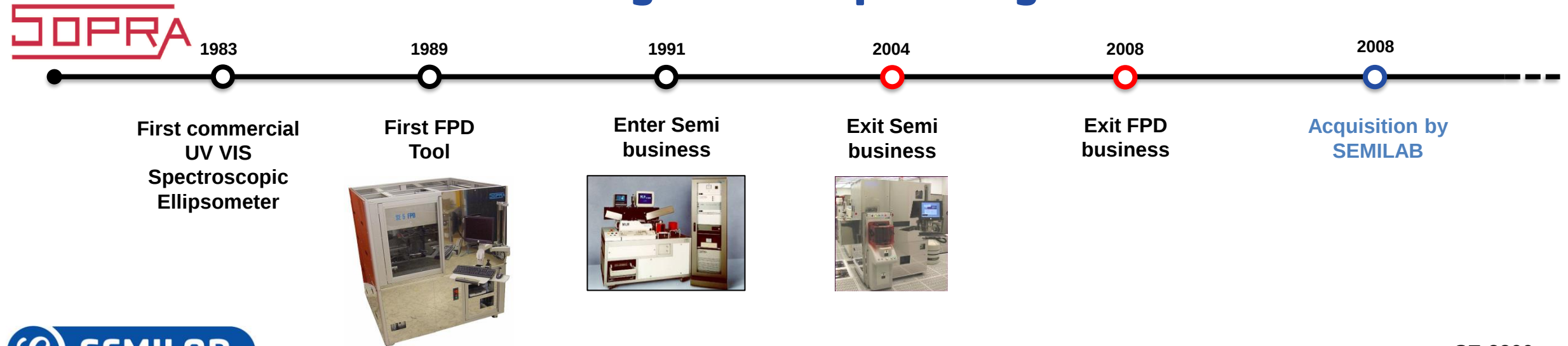
- **Air-Gap C-V Profiling**
- **Corona C-V Profiling**
- Contactless Resistivity Mapping
- Elastic-Metal C-V Profiling
- **Non-Contact Mobility by Microwave reflectance**
- Sheet Resistance Measurement by Eddy Current
- **Surface Charge Profiling**
- Wafer Geometry



Contact or Destructive Electrical Metrologies

- **Deep-level Transient Spectroscopy**
- **Spreading Resistance Profiling**
- **Mercury C-V Profiling**
- Parallel Dipole Line Hall Measurement
- Four Point Probe

40 years of ellipsometry



Addressing 8" fabs requirements

Films examples

Single layer Films

- Thermal Oxide
- Low K
- Nitride
- Oxynitride
- Photoresist
- Poly on Oxide
- Amorphous Silicon
- BPSG
- Polyimide
- Oxide on Nitride
- Oxide on metal
- Compound materials

Multi layer films

- Nitride / Oxide / Silicon
- Oxide / Polysilicon / Oxide / Silicon
- Oxide / Nitride / Oxide / Silicon
- Oxide / Nitride / Oxide / Polysilicon / Oxide / Silicon
- Polysilicon / Oxide / Silicon
- Polysilicon / Nitride / Silicon
- Nitride / Polysilicon / Oxide / Silicon
- Nitride / Oxide / Polysilicon / Oxide / Silicon
- Inorganic Low-k Dielectric / Silicon Carbide
- Oxide / Titanium Nitride / Aluminum
- Compound stacks
- Wide band-gap materials

Fab types:

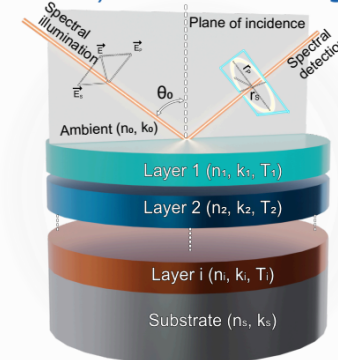
- Mature nodes > 28 nm
- All devices (Analog, Logic, Power, BCD, MEMS, Photonics)

Monitor:

- In-Line: Product wafers (50x50 um box)
- Off-Line: Monitor wafers (full sheet map)

Technology background

Ellipsometry is a **powerful, non-destructive optical technique** used for characterizing the properties of **thin films** and surfaces. It provides valuable information about the **optical constants** (refractive index and extinction coefficient), **film thickness, roughness** and more.



Ellipsometry is based on the interaction of **polarized light with a sample's surface**. It measures changes in the polarization state of light upon reflection from the sample.

The key parameters are the **ellipsometric angles** - Ψ and Δ - that describe the changes in amplitude and the **phase of the polarized light**.

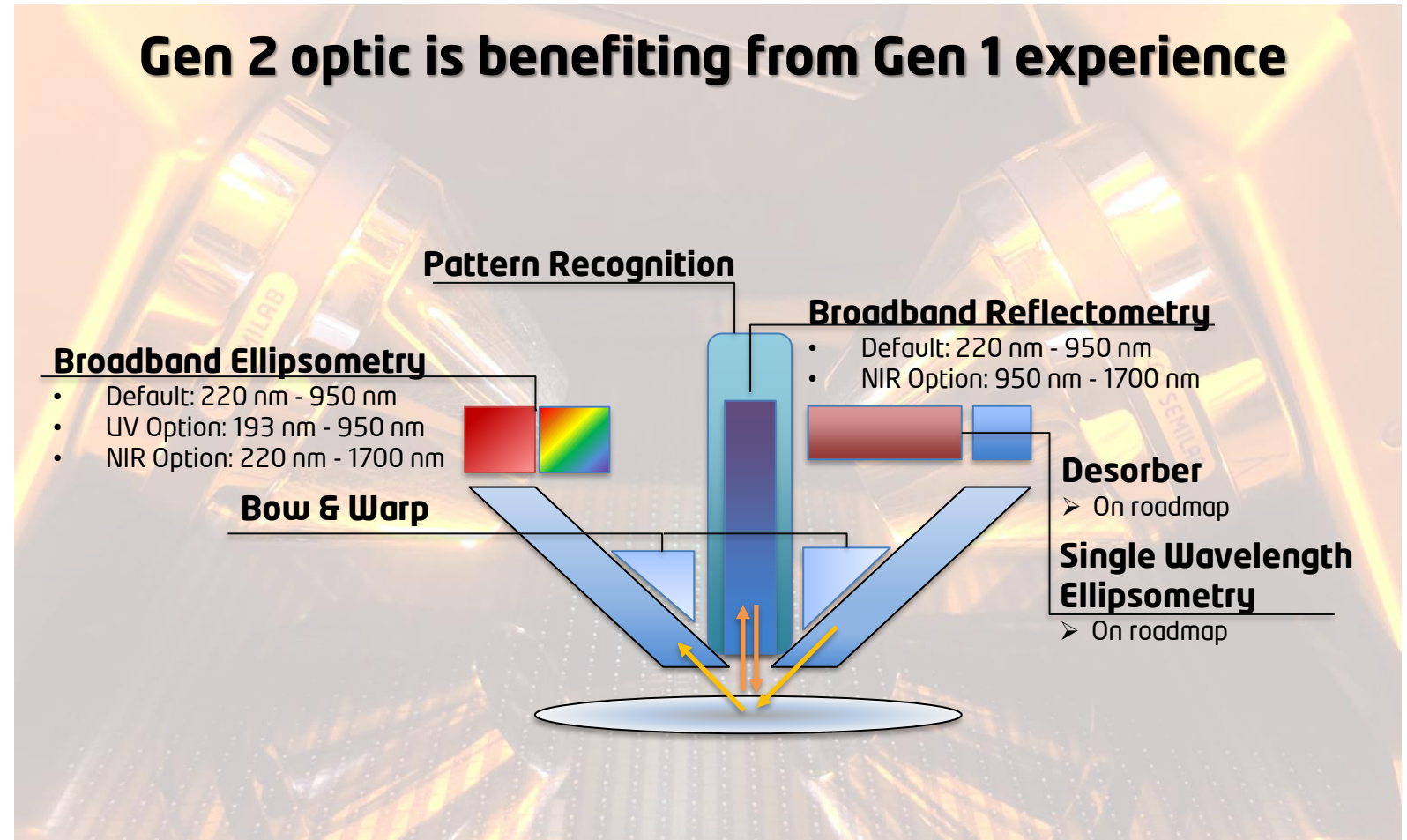
The metrology: Gen 2 Spectroscopic Ellipsometer

Configuration

- Microspot (50x50 μm box) - Pattern
- Spectroscopic Ellipsometry
 - Default: 220 nm – 950 nm
 - UV Option: 193 nm – 950 nm
 - NIR Option: 220 nm – 1 700 nm
- Spectroscopic Reflectometry
 - Default: 220 nm – 950 nm
 - NIR Option: 950 nm – 1 700 nm
- Bow / Warp
 - Option: Global wafer stress

Benefits

- Superior sensitivity
 - Rotating super-achromatic compensator
- Better SNR
 - High brightness light source
- Less maintenance
 - High brightness light source
- 2023 design



The system

Design:

- **4-8" fabs**
- **Low CoO**
- **Low Footprint**
- **Low service area:** back to wall, back-to-back
- **Versatile to all fabs configurations**
 - Open cassette or SMIF compatibility
 - OHT compatibility (for SMIF 8" and OC 4-8")
 - AGV compatibility (for SMIF 8" and OC 4-8")

Features:

- **4-8" capability** (different substrates)
- **100+ wph maximum throughput**
- Controlled mini environment (thermalization and filtration)
- Shuttered EFEM chamber (separated workzones)
- High throughput EFEM by dual arm robot
- 2 pcs built-in load port

Versatile Load Port
Configurations



Fab deployment

Planar films

- Ultra thin to thick
- Multistack
- 50 x 50 um measurement box
- Patterned wafers – In-Line

8" fabs

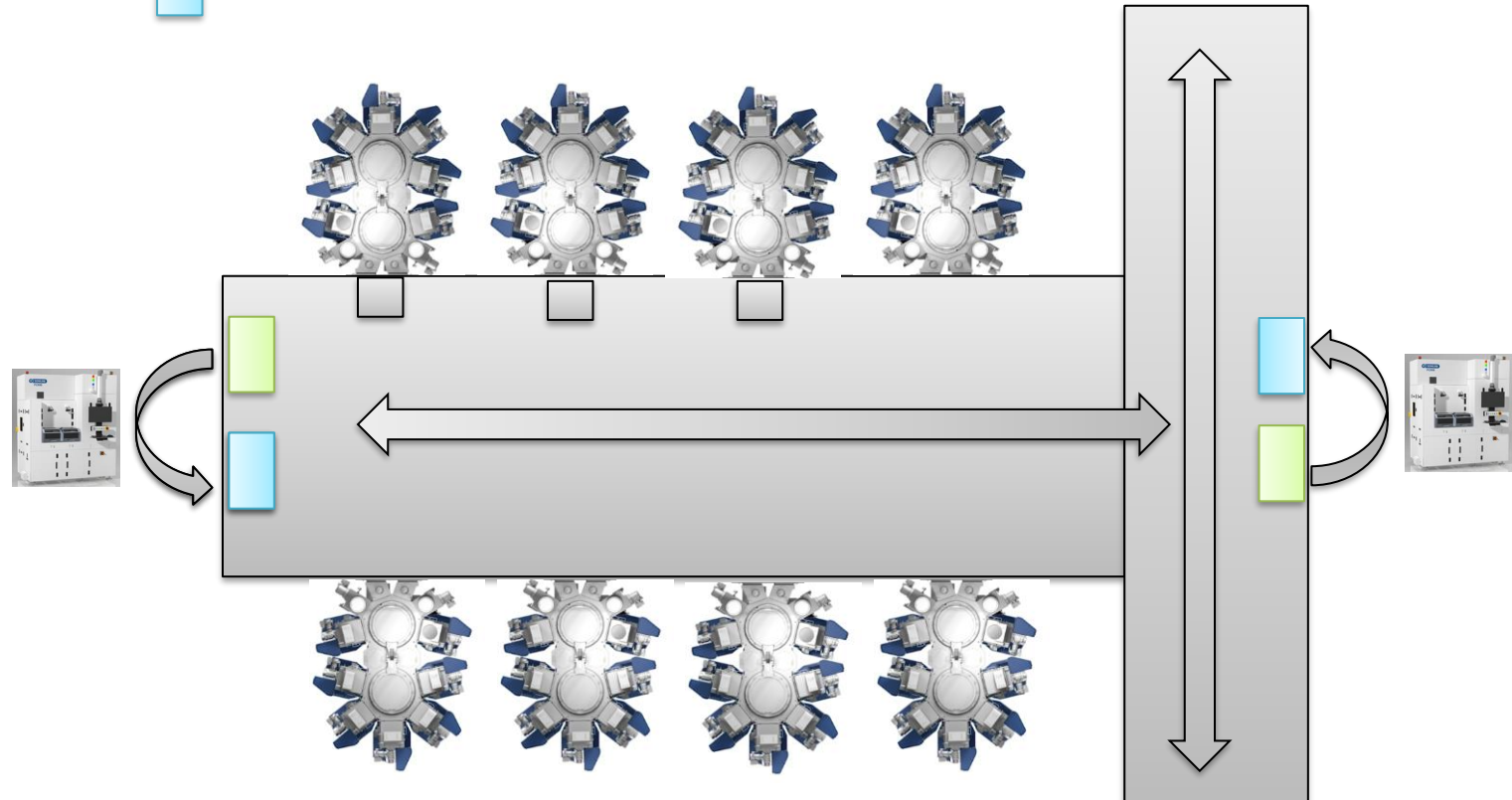
- Cost effective
 - Low foot print
 - Long lasting high brightness source
 - Low CoO
 - High Throughput

Drop in replacement

- Equivalent performance or better
- Fit in the space of existing legacy 200 mm Ellipso
 - Low footprint
- Recipe transfer from existing tools
 - WW Application team
- Tool matching with existing install base

 **Old film thickness system**

 **New uSE-2300**



Conclusions

Value proposition

- Drop-in replacement
 - 8" dedicated platform and requirements
- Recipe transfer
- Application support
- Low Cost of Ownership

Expertise

- 40 years of Ellipsometry history

Support

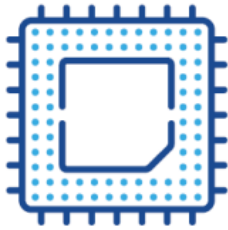
- Worldwide coverage for service and application

New platform design and performance to meet the 8" fabs needs





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New generation of ellipsometer to address 4-8" fab needs

As a leading innovator in precision measurement solutions, Semilab is proud to introduce its new **Compact Platform Microspot Spectroscopic Ellipsometer, the uSE-2300**. This new extension to the highly acclaimed Semilab SE series has a completely new platform arrangement with a newly designed metrology head, providing the well-established applications of the product family and improved throughput for wafer manufacturers and device makers.

Spectroscopic ellipsometry, a non-destructive technique aimed to **measure a wide range of layer thickness** from a fraction of mono-atomic layer to several micrometers **of transparent and semitransparent materials**, allows thickness determination of single layers and multi-layer stacks. In addition, it allows the absolute characterization of optical properties of materials by extraction of the N and K data. The latest member of the Semilab SE product line provides all key features of the well-known SE models crucial to provide **high precision and accuracy**, while also delivering further **improved platform stability**, a new generation metrology head and high throughput on a small footprint.

This new, small footprint system, uSE-2300 can be combined with spectroscopic reflectometer and laser ellipsometry within the same system. **Various metrology extensions** like bow/warp metrology, global stress calculation, MBD options are available upon request as well. In addition, the **highly configurable platform** can be adapted to support several sample types including wrapped, thick, or transparent wafers. Its high versatility and configurability make the Semilab uSE-2300 the ideal metrology solution for **various applications**, like thin film dielectric or semiconductor layer stack on a solid, polished surface substrate, **pattern-capable** spectroscopic ellipsometry on high-performance silicon CMOS or III/V devices after deposition and etching processes, OLED display & More-than-Moore industrial applications.

Building on the **knowledge of more than three decades in spectroscopic ellipsometry**, Semilab delivers the stable, robust design and high accuracy of the well-acclaimed SE line, now with further enhanced precision in an even smaller, faster, and more cost-effective form **available for order from early 2024**.

For more information contact SEMILAB via www.semilab.com/contact_us