

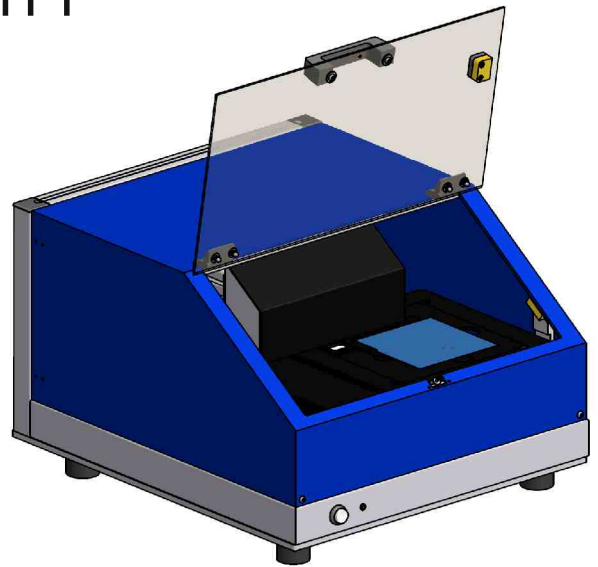
Helios SCAN-tn

Coating Measurement of Solar Cells;
Thickness and Refractive Index of Silicon Nitride

Helios SCAN-tn

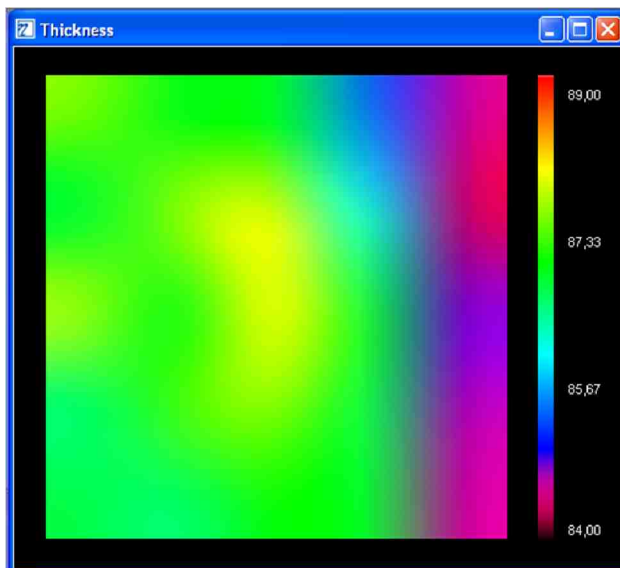
For wafer based solar cells the anti-reflective coating, surface passivation and diffusion barrier play an important role to achieve high solar cell efficiency and long term stability. Because of its excellent characteristics Silicon Nitride coating ($a\text{-SiN}_x\text{:H}$) is widely used for this purpose.

Process parameters like gas pressure and temperature of the cell during deposition have a strong influence on the layer thickness, colour and the optical constants n & k of Silicon Nitride. Traditionally it takes time and skills to obtain a precise coating distribution map to enable process optimization.



Measurement of Silicon Nitride

Using industry-proven spectrometer technology and proprietary measurement algorithms, Helios SCAN-tn combines speed, precise measurement and easy operation - all of which are needed to optimize processes at lowest cost and shortest line downtime.

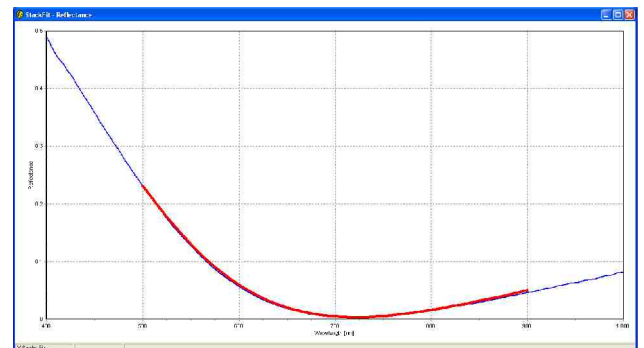


Thickness distribution map of the Silicon Nitride AR coating layer on a textured 156x156 mm pc-wafer, measured by Helios SCAN-tn in less than 1 minute

Principle of Measurement

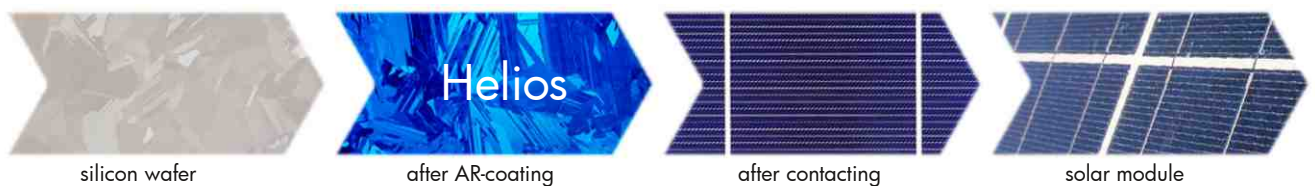
Phase differences between the front- and rear-side reflection of a thin layer cause interference. The frequency of this interference is proportional to the thickness of the layer. This phenomenon can be used to measure the layer thickness of very thin layers.

After recording the interference spectrum of the coated solar cell, a mathematical calculation is performed in which the layer thickness of a theoretical model of the layer stack is varied. When model and measurement match perfectly, the layer thickness is known very precisely.



Interference spectrum of Silicon Nitride coating on a textured wafer (measurement = blue / theoretical model = red)

Process Steps in which Helios SCAN-tn is used



Our proprietary algorithms take surface roughness of the silicon wafer into account, to enable highly accurate measurement on polished as well as rough wafers.

The detection optics as well as the measurement algorithms used for simultaneous measurement of layer thickness and refractive index of Silicon Nitride are an innovative method and are newly developed by NXT (other materials and dual layers on request).

Functions of Helios SCAN-tn

Helios SCAN-tn is a fully automatic measurement system that enables you to create coating distribution maps for the layer thickness as well as the refractive index of the coated wafer within less than one minute!

| | |
|--------------------------------------|---|
| Single-point measurement | ✓ |
| Layer thickness | ✓ |
| Refractive index | ✓ |
| Automatic XY positioning table | ✓ |
| Automatic calibration | ✓ |
| Automatic coating distribution plots | ✓ |
| Pre-configured mapping templates | ✓ |

Helios SCAN-tn, a good investment!

- Helios can be operated without any special skills (that are needed for conventional equipment)
- Helios delivers a meaningful coating distribution map in less than a minute
- Helios measures directly on textured mc- and pc-wafers, so no polished witness wafers are needed
- Due to its optimized optical setup, Helios is not sensitive to either sample height and tilt, or to crystal structures

Highlights of Helios SCAN-tn

LAYER THICKNESS & REFRACTIVE INDEX OF SILICON NITRIDE

- Offline / contactless and non-destructive
- High-speed mapping function

WORKS FOR ALL RELEVANT WAFER TYPES

- mc- & pc-wafers (polished, rough or textured)
- 125x125mm / 156x156mm

WORKS FOR ALL RELEVANT KIND OF TEXTURES

- Isotropic and anisotropic chemically etched
- RIE (Reactive Ion Etched)

WORKS FOR ALL RELEVANT DEPOSITION PROCESSES

- PE-CVD
- Magnetron Sputtering

EASY OPERATION

- Pre-configured mapping templates
- No special skills required for operation
- Select recipe. Start measurement. GO!

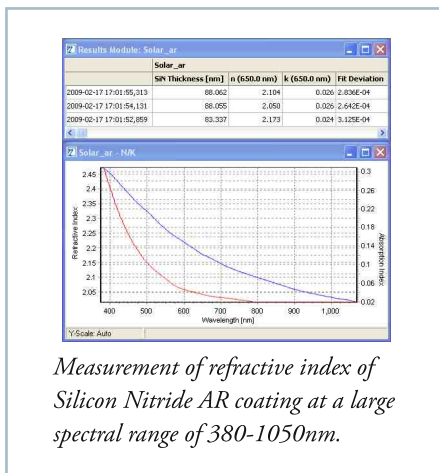
If you need a tool to help you to optimize your coating process in a fraction of the time and at a fraction of the cost of ownership of conventional equipment, then Helios SCAN-tn is your best choice.

Helios INLINE-tn – for mass production

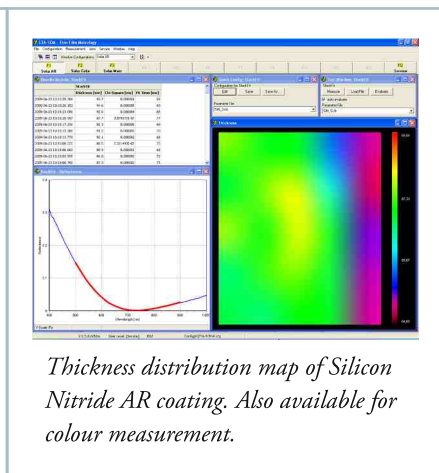
The exact same optics and algorithms are incorporated in Helios INLINE-tn. This unique inline system enables measurement of layer thickness and refractive index of Silicon Nitride on both rough and textured wafers during the production process and on moving wafers.

Learn more in the Helios INLINE-tn product brochure, or contact us today!

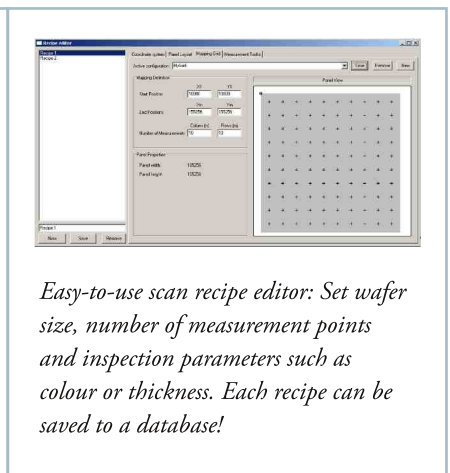
Presentation Examples



Measurement of refractive index of Silicon Nitride AR coating at a large spectral range of 380-1050nm.



Thickness distribution map of Silicon Nitride AR coating. Also available for colour measurement.



Easy-to-use scan recipe editor: Set wafer size, number of measurement points and inspection parameters such as colour or thickness. Each recipe can be saved to a database!

Product Specifications

MEASUREMENT

| Measurement Parameters | Layer Thickness / Refractive Index |
|----------------------------|------------------------------------|
| Wavelength Range | 380 ~ 1070 nm |
| Thickness Range | 45 ~ 120 nm |
| Refractive Index Range | 1.90 ~ 2.35 |
| Wavelength Accuracy | ± 0.5 nm |
| Thickness Accuracy | ± 1 nm |
| Thickness Repeatability* | 3σ < 0.5 nm |
| Refractive Index Accuracy | ± 0.02 |
| Refr. Index Repeatability* | 3σ < 0.01 |

HARDWARE

| | |
|-----------------------|---|
| Measurement Geometry | Patent pending optical geometry |
| Measurement Spot Size | ~ 10 mm |
| Measurement Speed | < 0.5s / point |
| Wafer size | 156x156mm/125x125mm /smaller wafer/larger wafer sizes are possible on request |
| Positioning Range | 200x200mm |
| Positioning Accuracy | < 0.1 mm |
| Environment | Temperature range: 15-35°C, (50-90°F), Humidity: <80% (non-condensing) |
| Power | AC 100~240V; 50/60Hz |

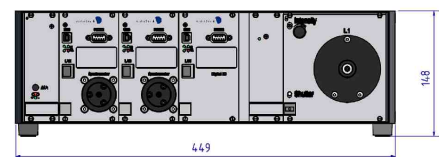
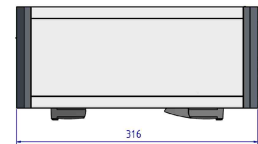
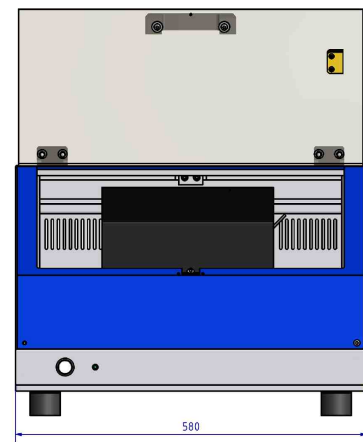
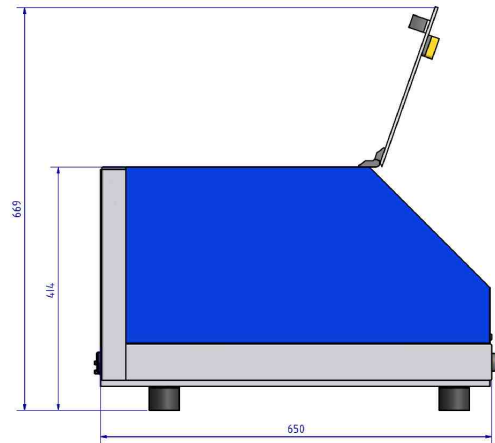
PC / SOFTWARE

| | |
|-------------------------|--|
| Measurement Functions** | Layer Thickness / Refractive Index / Mapping |
| PC Requirements | Windows® 7 / 8 / 10, 8 GB RAM, >500 GB hard disc space |

* 100 successive measurements at one single static position

** Depending on Helios system version

System Dimensions (in mm)



System dimensions for Helios SCAN-tm + Spectral Measurement system excluding operating PC

