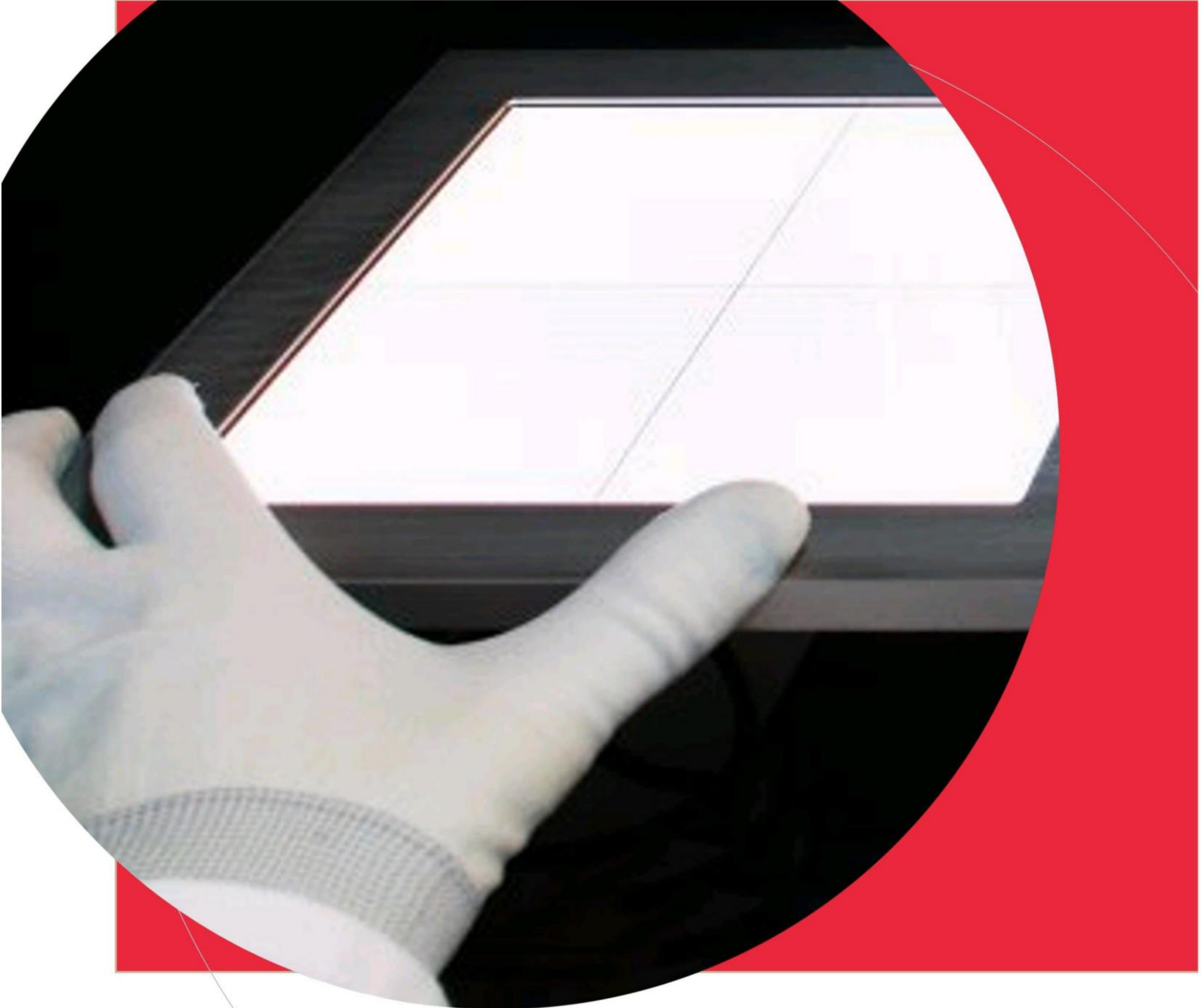


Xelas INLINE-oled

Inline control of OLED thicknesses
for organic and ITO layers

NXT

Xelas INLINE-oled : Organic and ITO **thickness control for OLED production**

Patented RT-Method!

High-efficient production of organic light-emitting diodes (OLED) need accurate thin film thickness control of the coatings of many different materials. Real-time measurement on the one side must be combined with true thickness values output on the other side. This enables OLED production to run both in high speed and with correct layer thicknesses.
Unlike other applications, in the case of OLED, there is no space for "B"-quality, thus an accurate control of the layers is essential. To keep the values stable, one needs a measurement equipment, being robust to disturbing influences, like tilt or sample height variations with respect to the standard measurement level.
Special optical design is essential to provide accurate spectral measurements in reflectance and transmittance, from which the thicknesses are determined in fast speed.

Full 3-channel RT-setup for inline thickness and n&k control

Solution for OLED inline measurements

NXT offers unique equipment to measure the layer thicknesses as well as refractive and absorption index of any kind of layer or stack, taking surface roughness into account. The system's optical RT-heads are designed and optimized for high-accurate and stable inline testing to guarantee absolute measurement results under production conditions.

Highlights of Xelas INLINE-oled

Measurement of all OLED layers:

- Layer thickness 5nm-500nm
- Spectral material properties n(λ)/k(λ) incl. data base of common materials

Works under real process environments

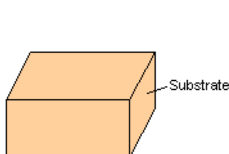
- Special design of both R- and T-head for highest value stability with respect to height and tilt tolerances in production
- Inspection through glass windows: No affection of production during maintenance
- Automatic internal calibration
- Contactless and non-destructive

Production-safe inspection setup

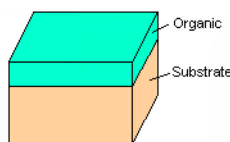
- Auto-triggering or I/O with the line
- Monitoring of thicknesses in real-time, without disturbing the production process
- Fast measurement speed

Fiber multiplexing system for multi-channel inline control

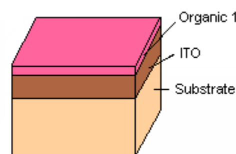
Process Steps in which Xelas INLINE-oled is used



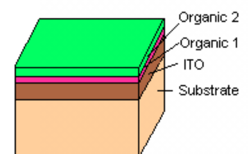
Substrate: glass or foil



after ITO or organic coating



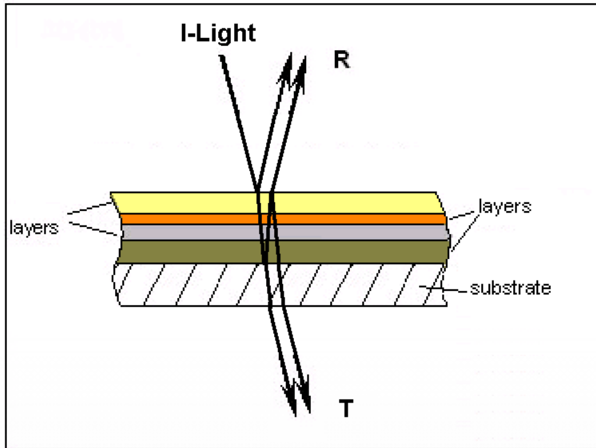
after organic 1 coating



after organic 2, 3, 4... coating

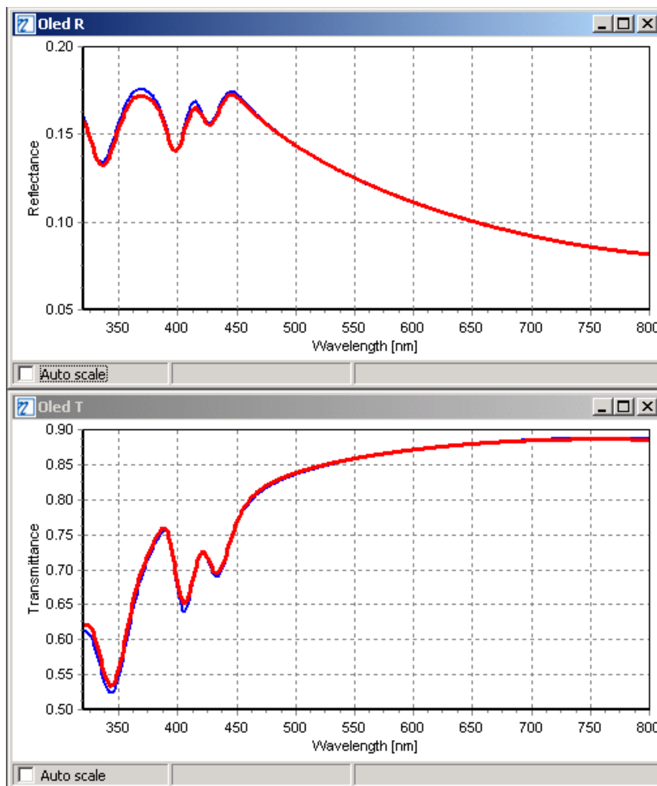
Principle of Measurement

Phase differences between the front and rear side reflection of thin layers cause interference. Absorption inside each layer changes light wave amplitude. Both of these phenomena can be used together to measure the layer thickness and refractive and absorption index n&k of thin layers.



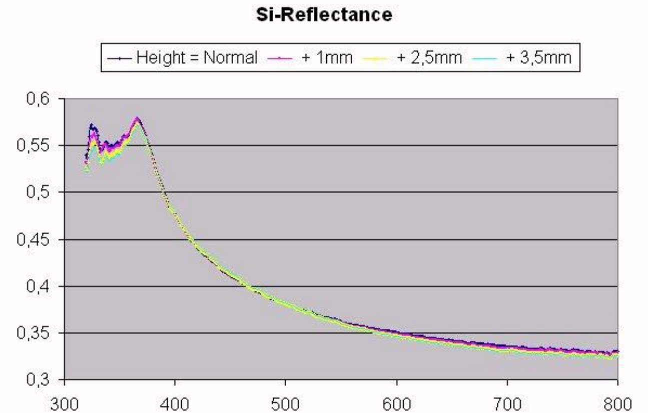
Reflectance R and transmittance T at a layer stack

After recording the spectra of the sample, an automized mathematical calculation is performed in which the layer thicknesses and the parameters for the optical properties n&k are varied until model and measurement match perfectly.



Spectral fit of R and T of an organic coating on a glass substrate (measurement = blue / model simulation = red)

Besides our proprietary algorithms using a special type of oscillatory model, which is applicable to all kind of materials, we need precise and stable spectral data. Our special design of the measurement heads and hardware guarantees the best accuracy of both reflectance R and transmittance T, based on long-year experience of these measurements in other fields.



Stability of reflectance with respect to sample height variations

Flexible systems with the number of measurement channels free from 1 to 9 positions are necessary to fulfill any present or future request for inline control. Our multiplexer setup is designed for such upgradable inline installations, using chosen high-quality components for fast and reliable R+T spectral output.

Inline measurements of thicknesses and n&k are the key to:

→ Stable production process
→ High OLED layer homogenity
→ Fast feedback in case of problems
→ Yield optimization for even the most advanced production setup

Xelas INLINE-oled enables producers of OLED to:

- Keep production conditions stable and increase production/process yield
- Check the product quality by detailed knowledge of thickness drifts, as well as changes in material properties
- 100% production control by automatic logging of every output data

Ready for both for OLED lighting and OLED display!

Product Specifications of Xelas INLINE-oled

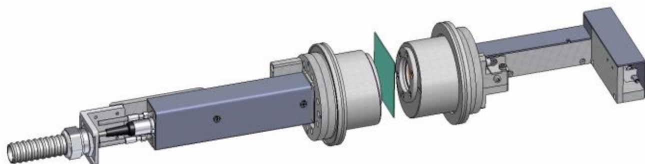
MEASUREMENT	
Measurement Parameters	Layer thicknesses of single layers and stacks / spectral refractive + absorption index (n&k)
Wavelength Range	320 ~ 800nm (other ranges on request)
Thickness Range	2 ~ 500nm
Refractive Index Range	0.01 ~ 10.00 (all materials possible)
R+T Accuracy	± 0.4%
Thickness Accuracy (on glass or foil)	± 0.6nm (range 2nm-40nm) ± 1.2nm (range 40nm-200nm) ; ± 2.2nm (range 200nm-500nm)
Thickness Repeatability	3σ < 0.2nm
Refractive Index Accuracy	ITO + metallic layers : ± 0.04 ; Organic layers : ±0.03 ; Dielectric layers : ±0.03
Refractive Index Repeatability	3σ < 0.02

HARDWARE	
Measurement Geometry	White light reflectance (R) and transmittance (T) in normal incidence (0°)
Measurement Spot Size	~ 1mm
Measurement Speed	≤ 1.0 sec. / point for thickness ; approx. 0.3-1.0 min. / point for n&k
Sample Sizes (default)	10x10mm to 300x300mm (larger sample sizes are possible on request)
Required Positioning Accuracy of sample	Within ± 1.5mm height and within ± 0.4° tilt
Environment	Temperature range: 5-45°C (50-90°F), Humidity: < 80% (non-condensing)
Power	AC 100 ~ 240V; 50/60 Hz
Dimensions W/D/H (Width/Depth/Height) (Rack: Other types on request)	Rack with spectrometer and light source : W= 449mm ; D= 376mm ; H= 317mm Reflectance Sensor (excl. Fibers) : W= 113mm ; D= 113mm ; H= 434mm Transmittance Sensor (excl. Fibers) : W= 190mm ; D= 113mm ; H= 295mm Fiber lenghts (other values on request): 2m, 3m, 5m

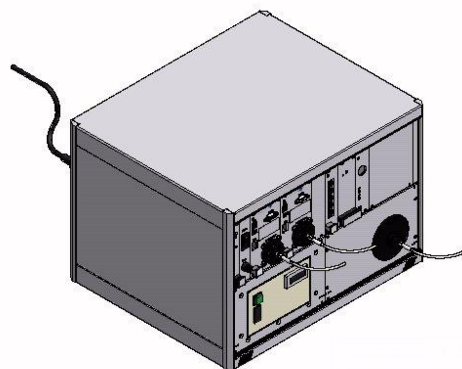
PC / SOFTWARE	
Measurement Functions	Layer thicknesses / refractive + absorption index / value history / mapping
PC Requirements	Windows® 7 / 8 / 10, 8 GB RAM, >500 GB hard disc space

Setup parts

Xelas INLINE-oled : R+T Sensors



Xelas INLINE-oled : Spectrometer Rack



Spectral Sensors R+T for Inline Reflectance+Transmittance Measurement (left) / 7HE Rack with R+T spectrometers and Xenon UV light source (right)

Product specifications are subject to change without notice. © NXT, 2017 www.nxt91.com

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