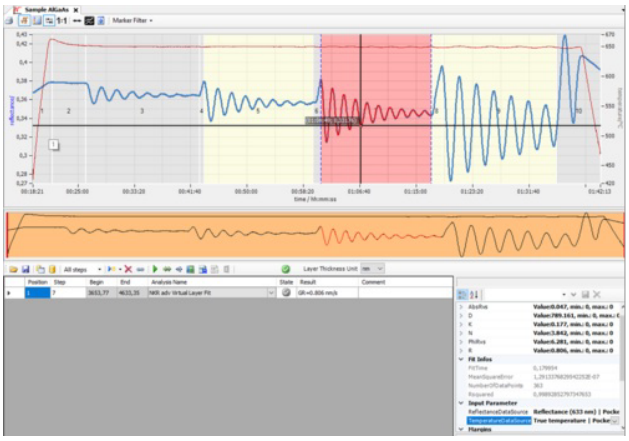
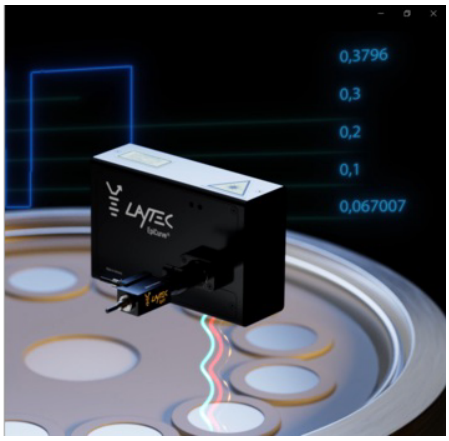
MEMBER OF THE NYNOMIC GROUP

Newsletter September 2023

With this newsletter, LayTec is taking the next step in communicating to its customer base. With the new format we will be more efficient in compiling the most relevant information and distributing it to you. We also encourage all readers to actively get in touch with us via **info@laytec.de**. We value your feedback and are looking forward to hearing from you!





Starting today: EpiNet's 'Algorithm Deep-Dive' series

Getting the best out of your LayTec data: Learn how to analyze your in-situ data most efficiently!

We are introducing our new 'Algorithm Deep-Dive' series. From now on, we will regularly introduce one of LayTec's advanced in-situ algorithms featured in our EpiNet software here and on **LinkedIn**. With this series, we would like to help you to fully use the possibilities of EpiNet to the benefit of your epi process.

Today, the series starts with the 'NKR adv virtual layer fit' allowing for the simultaneous fitting of the refractive index *n*, the extinction coefficient *k* and the growth rate *r* during epitaxial growth of virtually all materials.

The 'NKR adv virtual layer fit' will calculate fit results for refraction index *n*, *k* and *r* for reflectance transients obtained by LayTec's EpiCurve TT and EpiTT.

It's a powerful analysis method for thick (>1 oscillation period visible) smooth layers of all (even unknown) materials. No optical properties need to be known. If available, further knowledge about the material properties can be used for restricting the parameter space. Here, either database values or data from external sources can be used.

Usage ideas and alternatives:

- Use this analysis for thick smooth layers like e.g. contact layers, buffer layers, etc.
- By fixing the growth rate with thickness information about the layer from ex-situ measurements (e.g. XRD) it is possible to use this analysis to obtain temperature dependent *n* and *k* data for unknown materials
- For known materials, the multi-wavelength fits offer a faster and more precise analysis (to be covered in future volume of this series)

Limitations:

- The reflectance measurement has to be correctly calibrated
- Suitable for relatively thick layers only (>1 oscillation period, typically >150nm, depending on refractive index)

User instructions can be found in the EpiNet manual and can be obtained via **info@laytec.de**. Reference data is available within EpiNet.

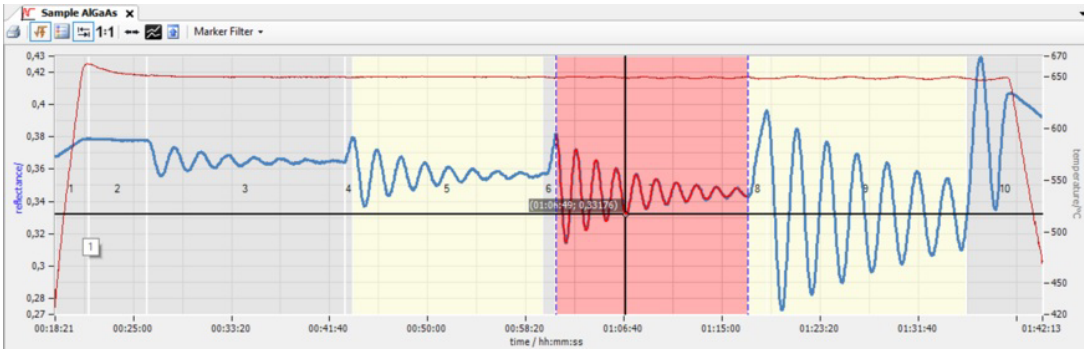


Fig. 1: Analysis screen of EpiNet® applying the 'NKR adv virtual layer fit' allowing for simultaneous fitting of the refractive index *n*, the extinction coefficient *k* and the growth rate *r* for analyzing materials like AlGaAs. Here, the fit was exclusively applied to the process step marked in red.

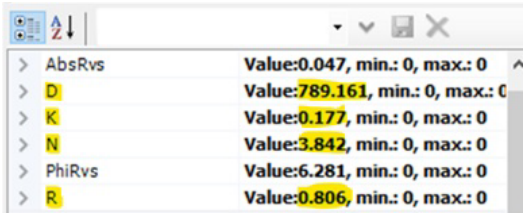


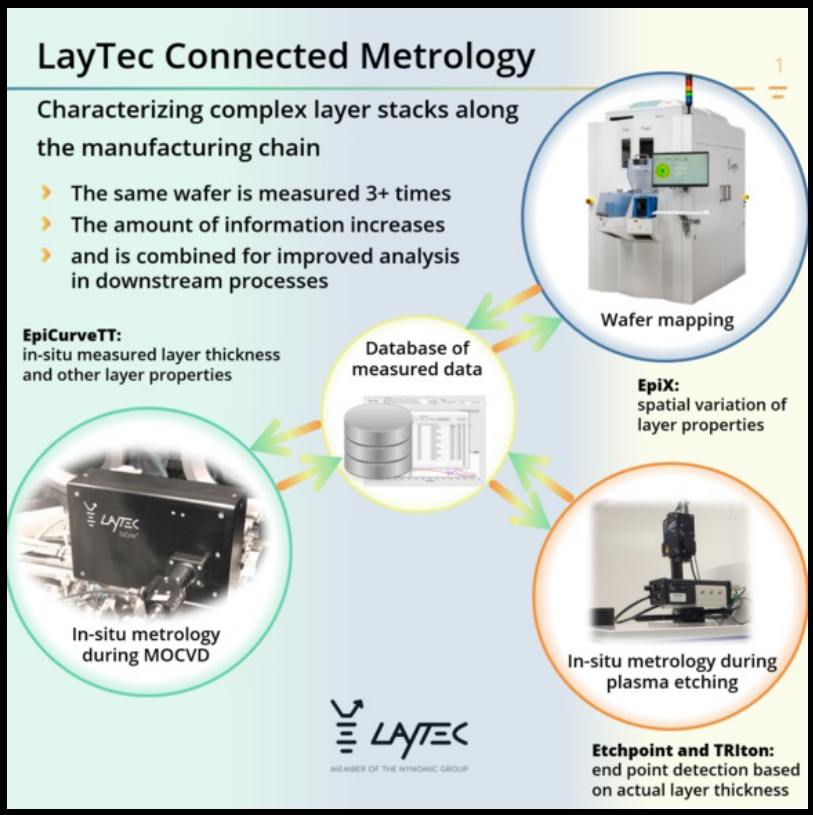
Fig. 2: Results window displaying the values for the thickness (D; in nm), the extinction coefficient (K, dimensionless), the refractive index (N, dimensionless) and the growth rate (R; in nm/s).

Please feel free to contact our support team via**info@laytec.de** for further introduction in a dedicated EpiNet training or for receiving sample data for exploring the possibilities of the algorithm on your own. Follow us on **LinkedIn** and stay tuned for further 'Algorithm Deep-Dives' in our upcoming posts!

Get to know our 'Connected Metrology' concept: the combination of measurement resulsts from LayTec's tools that leads to a new level of compound semi process control

Dr. Johannes Zettler's talk on 'connected metrology' from the Malvern Panalytical Advanced Materials Future Days event is available on YouTube! You can watch it **here.**

Or check a PDF of the presentation **here.**



Oxford Instruments Plasma Technology rolls out LayTec's Etchpoint metrology system for in-situ monitoring of AlGaN atomic layer etching

As previously announced, LayTec supports Oxford Instruments Plasma Technology by providing a patent-pending OEM metrology system for precise within-layer-endpoint detection during AlGaN atomic layer etching (ALE) for recessed gate MISHEMT device structures. Hereby, the Etchpoint etch depth detector precisely determines the current etch depth with a precision of ±0.5nm in combination with ALE. Details about Etchpoint and Oxford Instruments Plasma Technology's tool can be found on the **product page**.

Fig. 3: LayTec's Etchpoint metrology system mounted on a PlasmaPro 100 Atomic Layer Etch system for endpoint detection.

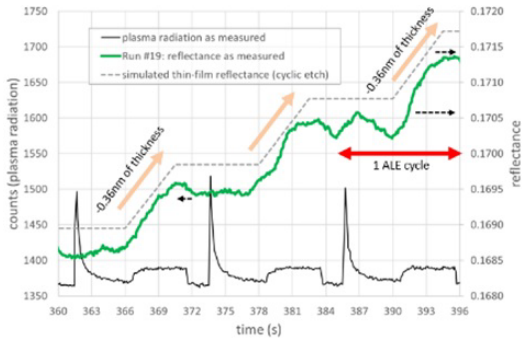


Fig. 4: Green: reflectance transient recorded during an AlGaN ALE process; grey: intensity of the plasma radiation. The atomic etching steps are clearly resolved in the reflectance signal.

Interactive feed-back control for pocket temperature during epitaxial growth of 230nm UV-LED structures

At the International Workshop on Ultraviolet Materials and Devices (IWUMD) in Metz, France, in June LayTec's CTO Dr. Kolja Haberland presented results obtained by LayTec's research partner Ferdinand-Braun-Institut (FBH) on how LayTec's EpiCurve TT metrology system can be used interactively for controlling pocket temperature during the growth of UV-LED structures in a feed-back-control mode.

At FBH, a comparative method was developed for addressing run-to-run deviations in the pocket temperature which were observed for epitaxy processes with identical heater settings. Thereby, the pocket temperature was measured by EpiCurve TT applying pyrometric measurements at 950nm. These measurements allowed to compensate any deviations observed in a process at a given heater setting with respect to a reference run which produced layers of the desired properties.

The corresponding procedure is displayed in Fig. 5. As can be seen, two runs which are initially ① started at identical heater temperatures (black trace) led two different pocket temperatures (red trace). In order to reach the desired pocket temperature of Run A also in Run B, the heater temperature was reduced at time ②, so that identical pocket temperatures were achieved at time ③. Later, the same procedure was also applied again at different process conditions in the second half of the run . This example shows nicely, how the comparative data display in EpiNet combined with the EpiCurve TT allows to compensate for run-to-run deviations in order to achieve layers of desired quality and properties.

Check all slides of Dr. Haberlands talk on our **YouTube** channel and follow us on **LinkedIn** for more updates on how your process can benefit from in-situ metrology!

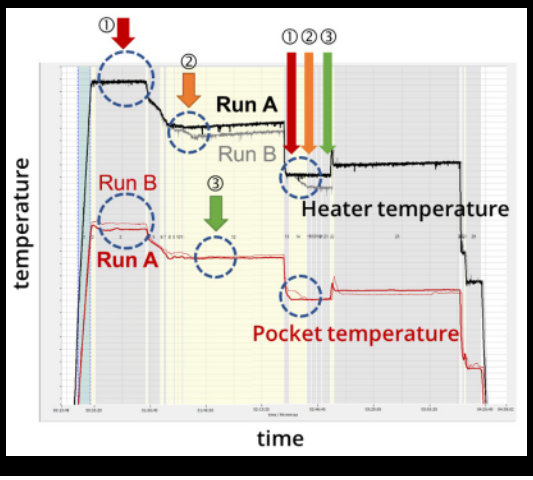


Fig. 5: Comparison of Run A and B (identical recipe): ① Same heater temperature > Run B shows higher pocket temperature; ② Correcting for difference: lowering heater temperature in Run B > ③ Same pocket temperature established as in Run A. Subsequently, same procedure was applied in 2nd half of the run.

We are very proud to announce our new sales & service partner for LayTec's metrology solutions for the photovoltaic industry: all4-GP North America Inc.

all4-GP North America Inc will take over all PV-related distribution and service activities for LayTec in the United States, Canada and Mexico. As PV activity is soaring in North America, LayTec is glad to be able to provide faster and more direct support for all partners and customers in the region!

all4-GP North America Inc. is a technology orientated business that is focused on providing manufacturing equipment and process solutions for the photovoltaic industry and others. They offer manufacturing and metrology systems, and customized engineering solutions to their customers and have a team of experienced engineers who work closely with them to provide optimum solutions and service.

For more information, please contact Matthew Gansen, **matt.gansen@all4-gp.us** or LayTec **info@laytec.de**

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