LAYTEC

MEMBER OF THE NYNOMIC GROUP

vol #4

EpiNet®'s "Algorithm Deep-Dive" series

Learn how to analyze your in-situ data most efficiently

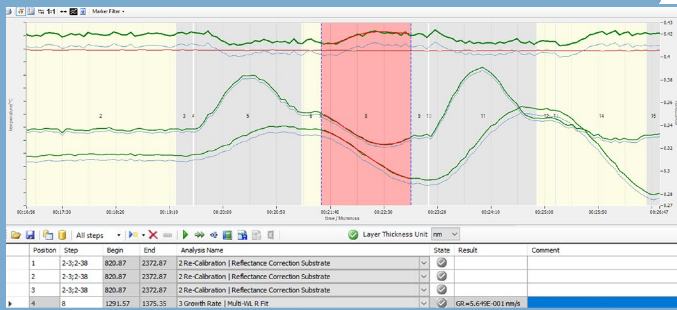

Fig. 1: Analysis screen of EpiNet® applying the "MultiWL Growth Rate" fit allowing for deducing the growth rate and film thickness by fitting all three (or two) wavelengths transients whilst requiring an identical growth rate for all of them based on pre-known refractive index n and extinction coefficient k. Here, the algorithm was applied to a thin InP layer grown within a quantum well structure growth run where the respective values of n and k were taken from the EpiNet® database. Note that in this example only a fraction of a full oscillation was measured for the InP deposition step.

Algorithm profile

Algo name: The "MultiWL Growth Rate Fit"

Short description:

- The **"MultiWL Growth Rate Fit"** exploits the fact that in an EpiTT/EpiCurve® TT measurement, transients of several wavelengths (usually 405 nm, 633 nm, 950 nm) are measured simultaneously. Since the oscillations of all transients are caused by the same growing layer, they must exhibit the same growth rate.
- This additional requirement proves to be a powerful tool for increasing the robustness of a growth analysis and for obtaining very accurate determination of the growth rate for known materials as long as the applied model agrees well with the physical nature of the growing stack.
- This fit is usually the most appropriate algorithm, if the material system is known (with known n and k from EpiNet's database) and highest precision for the growth rate is desired.
- It is particularly helpful, if thin layers are to be analyzed. In this case, only a small fraction of the oscillation can be recorded during deposition. Therefore, fitting the growth rate and/or thickness based on just one wavelength will be rather ambiguous. In contrast, if all available wavelengths are analyzed by the **"MultiWL Growth Rate Fit"** a robust analysis becomes possible even for very thin layers with significantly less signal than one full oscillation period.
- Modifications of this algorithm ("MultiWL Composition Fit" and "MultiWL Growthrate Fit with Reflection Correction") also exist for particular use cases and will be subject of upcoming editions of our Algorithm Deep-Dive Series.

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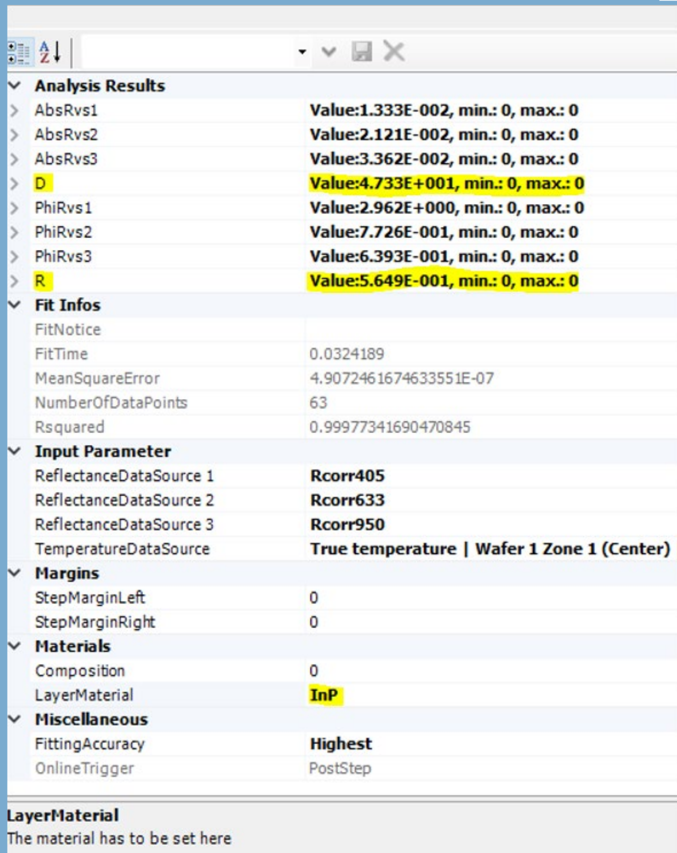

Fig. 2: Results window displaying the value (47.33 nm; 0.56 nm/s) for the thickness (D; in nm), and the growth rate (R; in nm/s). Additionally, the selected growing material is listed in the lower section.

Algorithm profile

Usage Ideas and Alternatives:

- Obviously, the algorithms requires two or three valid wavelengths transients in order to increase the robustness of the fit.
- Particularly for very thin layers, the **"MultiWL Growth Rate Fit"** can enable a robust determination of the film thickness, whereas a fit based on just one wavelength might yield rather ambiguous thickness values.
- Note that it is artificially restricted to three wavelengths and could be extended to more in the future.
- In case of only two wavelengths one wavelength has to be selected twice.
- For ternary materials, insert the Composition in the corresponding field.
- In case of uncertainty about the composition or the validity of

User instructions can be found in the manual and can be obtained via info@laytec.de.

Reference data is available within EpiNet®.