



Precise on-site temperature calibration with LayTec's AbsoluT

LayTec has developed the ultimate temperature calibration tool for its EpiTT, EpiTwinTT and EpiCurve®TT tools: AbsoluT. It provides a reference intensity that equals a known pre-calibrated temperature around 900°C which is used for temperature calibration through the original viewport with unrivaled accuracy. It can be applied directly in the MOCVD chamber without any modification of the in-situ tool or MOCVD equipment.

AbsoluT helps to correct all reactor-to-reactor and ring-to-ring temperature variations caused by adjustment, window coating or manufacturing tolerances of the equipment, such as viewport diameters. The new method replaces the less accurate and more time consuming method of eutectic calibration that has been applied until now.



Fig. 1: AbsoluT in operation: the operator positions the reference light emitter with its emitting area (PEEK contact surface) against the lid where the temperature view port is located



Fig. 2: Delivery content: 1 - handheld device with the reference light emitter, 2 - rechargeable battery pack, 3 - temperature resistant cables, 4 - battery charger, 5 - tool case

A calibration with **AbsoluT** takes only 30 minutes per reactor and profoundly shortens maintenance cycles. The user just has to transfer the **AbsoluT** head into the chamber and position it with its heat resistant surface against the reactor lid under the optical view-port (**Fig. 1**). The calibration data is automatically tracked and processed in order to provide an updated configuration file. Recently, the new method was successfully approved at industrial customer sites.

A customer who tested **AbsoluT** stated: "Your new calibration method is very successful. After calibration the temperature measurement in MQW showed identical results in each system. Your team did a very good job here!"

In **Fig. 3** we show typical reactor-to-reactor variation in temperature measurements before and after calibration. **AbsoluT** was used in 5 identical CRIUS reactors running the same LED recipe. The initial

values (black) were gained with reference to the black body pre-calibration before shipment. They are obviously higher than the real temperature because the viewport aperture used during the black body calibration differs from the real aperture in operation. The head-to-head or reactor-to-reactor variations are in the range of ± 7.5 K.

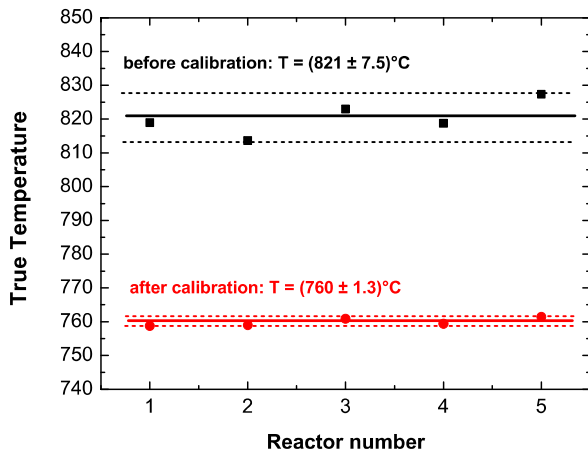


Fig. 3: Temperature measurements in 5 identical reactors before calibration (black) and after calibration (red).

As the original viewport of the MOCVD system is not available at LayTec for pre-calibration, on-site variations of the viewport diameter (typically in the range of 10 %) cannot be corrected. The viewport aperture, however, affects temperature sensing in CRIUS type of reactors significantly because the intensity of the IR radiation detected by the pyrometer changes if the view-port diameter differs. The new **AbsoluT** calibration completely eliminates these effects: after temperature calibration (red), the correct temperature of 760°C was measured and the temperature variation of ± 1.3 K was validated by identical photoluminescence (PL) emission wavelength of the wafers from all 5 reactors.

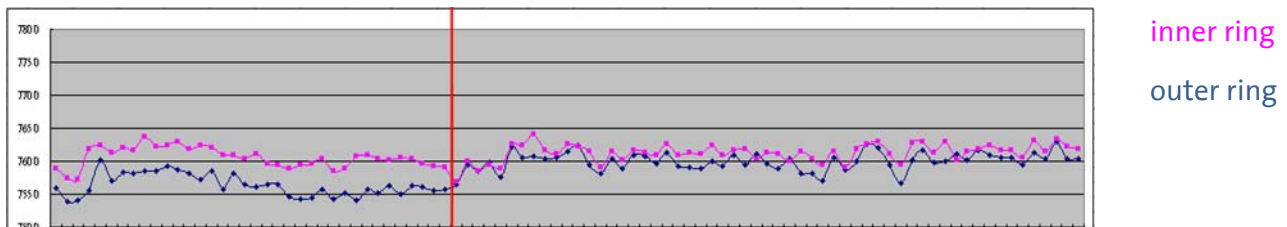


Fig. 4: temperature measurement with **EpiTwin TT** in a CRIUS reactor before and after calibration with **AbsoluT**: the red line shows the calibration point.

Fig. 4 shows temperature measurements performed with LayTec's double-head sensor **EpiTwin TT**. Before calibration with **AbsoluT** a temperature offset of 4 K between the inner and outer ring was visible (left from the vertical red line). After the calibration both temperature curves are in agreement and there are no ring-to-ring temperature differences anymore.

Calibration with **AbsoluT** is a must for establishing stable production conditions within narrow device specifications. It enables the absolute accuracy of temperature measurement in the range of ± 1 K, improves data quantity and quality for process control and reactor-to-reactor supervision and allows a faster feedback response for failure analysis. Besides, the easy use of the tool reduces down times during maintenance intervals. Calibration with **AbsoluT** is essential to all customers who want to compare the temperature measured in-situ in different reactors.

AbsoluT is available to all LayTec customers using **EpiTT**, **EpiTwinTT** and **EpiCurve®TT** tools in AIXTRON Planetary® and CRIUS reactors.