Precise heating zone control: EpiTriple TT with AbsoluT temperature calibration

The precision of temperature measurements is crucial for a proper in-situ monitoring of epitaxial growth. It is even more important if you measure temperature at different points on the same wafer, on different wafers or in different reactors simultaneously or if you compare the temperature of different runs.

Dr. Tony SpringThorpe of the National Research Council of Canada reported recently about fast and easy temperature calibration of all 3 heating zones of his showerhead reactor. Dr. SpringThorpe uses LayTec's AbsoluT for calibration of EpiTriple TT that monitors the growth of As- and P-based devices by 3 measurement heads at 3 different viewports. AbsoluT sets up one exact reference point for pyrometry measurements at 3 viewports, where temperature variations are often caused by adjustment, window coating or manufacturing tolerances of the equipment. According to Dr. SpringThorpe, "AbsoluT is a quantum leap compared to the former calibration methods. It takes only 5 minutes to calibrate all 3 heads and requires no further calculation. Hence, I can take under real-time control all 3 heating zones. This helps enormously to grow uniform buffer and MQW structures. I am convinced that every MOCVD system should be equipped with AbsoluT."

Fig. 1: AbsoluT attached to a showerhead reactor lid for calibration.

For further information please ask us for the presentation of Dr. SpringThorpe or visit www.laytec.de/absolut

Strain engineering for GaAs-based laser structures with EpiCurve® TT

It is known that MOVPE growth of AlGaAs on GaAs is limited by lattice mismatch at room temperature and not at growth temperature [1]. The resulting wafer bow may cause problems during the subsequent processing and chip mounting of edge-emitting laser diodes.

In order to reduce the wafer bow at room temperature, Dr. Andre Maaßdorf and his team at FBH Berlin (Germany) have developed a special scheme for strain engineering: they add phosphorus (P) and replace $Al_{0.85}GaAs$ by $Al_{0.85}GaAs_{0.96}P$ in a distributed manner.

To control their laser growth in an Aixtron MOCVD system in real-time, the team uses LayTec's EpiCurve® TT for simultaneous curvature, pyrometry and reflectance measurements to observe the curvature development, the temperature and the layer thickness.

Fig. 2 shows two curvature transients of an edge-emitting laser structure with and without strain-compensating (SC) AlGaAsP layers indicated by vertical arrows. These layers directly replace AlGaAs and have a thickness in the range of 230–350 nm.

The dashed lines show the curvature envelopes of both transients. The envelope for the non-compensated structure is tilted (grey dashed line), which leads to an increased convex bow throughout growth, but the envelope of the compensated structure is flat (blue dashed line).

Furthermore, we can see that compressive strain occurring during cool down (after ~1250 s) remains the same in both cases as it is caused by different thermal expansion of layer and substrate. However, the final room temperature curvature of the compensated structure is reduced by 38 km^{-1} (Fig. 2). Finally, Dr. Maaßdorf also describes the procedure for measuring by EpiCurve® TT the thermal expansion coefficient of ternary compound materials between room temperature and growth temperature [2]. For further information please contact info@laytec.de.

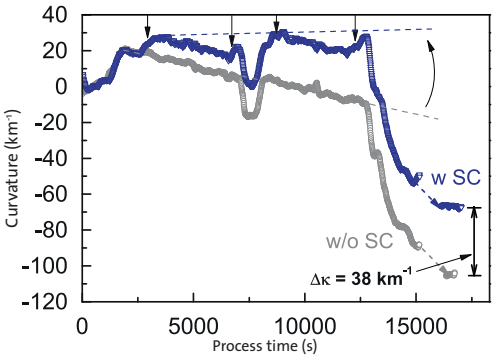

Fig. 2: In-situ curvature data of laser structure with (blue) and without (grey) SC layers (marked by arrows). Dashed lines show the envelopes of the curvature in both cases. [1]

[1] A. Maassdorf et.al., J. Cryst. Growth 370 (2013) 150-153

[2] A. Maaßdorf et al., J. Appl. Phys. 114, 033501 (2013)

You can meet us at the following workshops, conferences and trade fairs:

7 – 8 January 2014 | UKNC Annual Conference 2014 | Bristol, UK | www.uknc.org

12 – 14 February 2014 | SEMICON Korea - Booth 4626, 1F, Hall B | Seoul, Korea | http://prod.semiconkorea.org

2 – 6 March 2014 | International Symposium on Advanced Plasma Science (ISPlasma) | Nagoya, Japan | www.isplasma.jp