

## Major laser supplier chooses EpiTT FaceT for yield improvement

It has been demonstrated for edge-emitting GaAs-based lasers that the threshold for catastrophic optical mirror damage at the laser facets can be improved to levels higher even than the bulk damage threshold by ZnSe facet passivation in MBE [1]. For high-yield processes of facet plasma cleaning and passivation with ZnSe in MBE, however, it is vital to keep the temperature of GaAs laser facets at a highly stable and accurate set-point. This has been a challenge for many years because the radiative transfer from the MBE heater to the multi-laser stacks is subject to several parameters that are not easy to control (like thermal contact resistance between the laser stacks and their fixtures, the absorption coefficient of fixtures and carriers that varies with their lifetime, etc.). EpiTT FaceT is a temperature metrology system specifically designed for improving the yield of the facet coating process in the temperature range between 150°C and 400°C. A major supplier of industry-class high-power lasers has recently acquired an EpiTT FaceT for MBE facet coating in mass-production of multi-laser stacks. Fig. 1 shows the long-term

stability and low noise of the EpiTT FaceT's temperature reading of a selected single stack of lasers out of a set of laser stacks. The multiple stacks of lasers were mounted in fixtures on a carrier device in the MBE chamber under conditions identical to the real production process.

[1] Zhang, Q. et al., "Nature Sci. Rep. 6", 19011; doi:10.1038/srep19011 (2016).

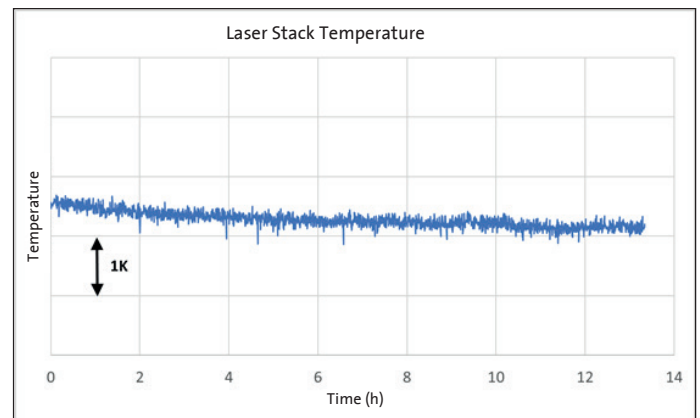


Fig. 1: Long-term stability of EpiTT FaceT's temperature reading of a selected single stack of lasers in a commercial production MBE for ZnSe facet passivation.

## EpiTT: optimizing MBE growth of InP-based quantum cascade lasers

In their recent MBE research project, P. Gutowski et al. from the Institute of Electron Technology in Warsaw focused on optimization of growth conditions of MBE-grown InP-based quantum cascade lasers (QCLs) [2]. For this purpose, their Riber Compact 21T MBE-System was equipped with an EpiTT 3W to perform in-situ analysis of the surface morphology and layer thickness. The EpiTT delivers reflectance at 950nm, 633nm and 405nm as well as surface temperature. Fig. 2 demonstrates that reflectance measured by the EpiTT in-situ metrology tool is highly sensitive to defect-driven surface morphology changes during growth of these rather thick waveguide layers, especially at 405nm and 633nm. The in-situ data in Fig. 2a show a clear decrease in all three reflectance signals at 520°C growth temperature while Fig. 2b verifies that the surface of the wave-guide layers stays smooth under optimized growth conditions at 480°C. The QCLs grown using the new recipe have shown lower threshold currents and substantially improved slope efficiency.

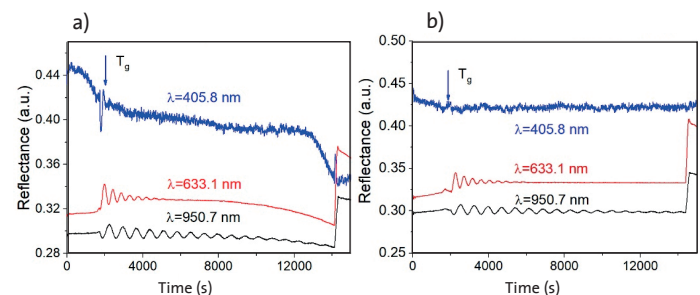


Fig. 2: EpiTT reflectance traces during growth of 2.5µm thick InAlAs layers at V/III=12: (a) at Tg=520°C and b) at Tg=480°C (cited from [2]).

[2] P. Gutowski et al., "Materials 2019", 12, 1621; doi:10.3390/ma12101621.

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05 February 2020 | SPIE Photonics West | CA, USA | LayTec talk:

Dr. Kolja Haberland on "Advances in in-situ metrology during epitaxy of UV-LEDs and related optical devices"

31 March 1 April 2020 | CS International | Brussels, Belgium | LayTec talk:

Dr. Iris Claussen on "Advanced in-situ metrology for high-yield epitaxy of SiC/SiC, GaN/SiC and GaN/Si device structures"