LAYTEC Knowledge is key

NEWSLETTER: September 2017

EpiTT VCSEL – shipments to leading VCSEL manufacturer

Last year we reported the first sale of EpiTT VCSEL for InP based epitaxy to a European lead customer. In Q2 / 2017 we finished the development of the respective tool for GaAs based VCSEL growth. The next two systems will be shipped in September 2017 to a leading VCSEL manufacturer in the USA. EpiTT VCSEL adds full spectral capabilities to the established performance of EpiTT (wafer temperature sensing at 950 nm and growth rate measurement based on 3 wavelength reflectance). Two spectral ranges can be chosen: 630 nm - 1100 nm for GaAs based NIR VCSEL epitaxy and 1000 nm - 1700 nm for InP based IR VCSEL processes. Either system delivers direct access to cavity dip position and stop-band wavelength control already during MOCVD. The cavity dip position is extremely sensitive to the accurate thickness and composition of QWs (quantum wells) / QBs (quantum barriers), oxidizing AlAs and other functional layers in the cavity. For optimum laser performance, this cavity dip position has to be in exact correlation to QW emission wavelength. Here another strength of EpiTT VCSEL comes into play: tight control of wafer temperature for highly precise QW composition. However, during cavity growth for some VCSEL designs, the standard wavelength of the pyrometer overlaps with the high reflectivity band of the underlying n-DBR (n-doped distributed Bragg reflector), causing high reflectance and hence low thermal emissivity of the wafer. Therefore, we added the possibility to customize the pyrometer wavelength of the EpiTT VCSEL. A second pyrometer module can be chosen between 810 nm, 850 nm, 980 nm. This allows accurate wafer temperature measurement for a wide range of VCSEL MOCVD processes. Fig.1 gives an example for a VCSEL with 940 nm target emission wavelength.

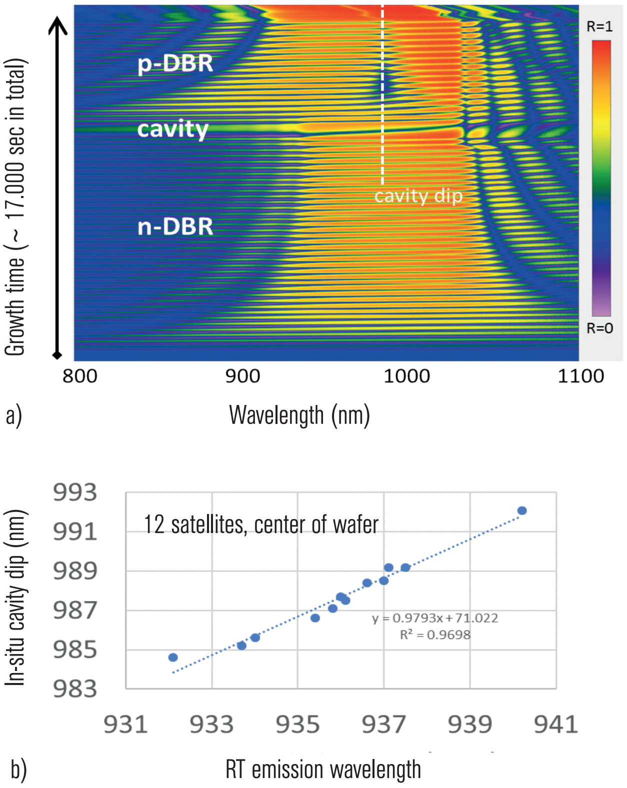

Fig. 1: 940 nm VCSEL grown in a 12 x 4" AIXTRON planetary G3 reactor of a European industry customer (full load qualification run). Panel a) shows the color-coded spectral fingerprint of satellite #1 (center of wafer). 36 of such in-situ signatures have been generated for center / half-radius / edge regions of all the 12 wafers. In b) we compare room-temperature-the ex-situ on-wafer emission in the 12 wafer centers with the respective in-situ cavity dip wavelength position. The cavity dip measured in-situ is fitted automatically in real-time to the measured spectrum (after last AlGaAs layer of p-DBR was completed at growth-temperature) by LayTec's EpiNet 2018 software. The extremely good correlation between in-situ measurement and the ex-situ data demonstrates that EpiTT VCSEL gives a reliable forecast on the performance of the device.

In-situ metrology system shipped to GaN-on-SiC customer

A comprehensive EpiCurve® TT / Pyro 400 in-situ metrology hybrid-system has recently been shipped to a North American industry customer. This metrology station combines automated in-situ wafer bow and film thickness measurements with two pyrometry wavelengths: NIR at 950 nm and near-UV. In GaN-on-SiC and GaN-on-Si MOCVD technology, the growth of sophisticated nucleation and strain management layers is essential for the quality of the material and the performance of the final devices. At the same time, these layers are a challenge for highly accurate wafer temperature control: IR light from other hot parts of the reactor is scattered into the NIR pyrometer and causes Fabry-Perot artifacts, affecting its precision. However, the GaN buffer specifically emits thermal radiation in the near UV and the temperature measured with Pyro 400 is not affected by the NIR thermal radiation scattered by the buried functional layers. Therefore the combination of NIR pyrometry with Pyro 400 allows to control the wafer temperature precisely during the whole deposition process.

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

24–26 Oktober 2017 | Workshop V2017 | Dresden, Germany
14–17 November 2017 | Semicon Europe | Munich, Germany