In-situ metrology for graphene growth

For several years, graphene has been the subject of intense research activity aimed at exploiting its unique properties. Although the growth of graphene is a very new and complex process, LayTec has developed a solution for in-situ reflectance analysis of the surface changes during growth. The first tests have been conducted during graphene growth on copper/silicon (Cu/Si) in a commercial CVD reactor. Our in-situ reflectometer has clearly demonstrated its sensitivity to surface processes like de-oxidation and roughening during graphene CVD on Cu. Furthermore, we could see that in case of growth on Cu/Si, the combination of temperature, low pressure and CH_4 supply does change the surface properties of the copper substrate and causes copper removal from the surface. Therefore, a sensor able to monitor in-situ both surface temperature and reflectance, like LayTec's EpiTT, can deliver valuable information to understand and optimize the deposition process. For details of the study and the first tentative results please visit www.laytec.de/solutions/advanced-rd or ask for our Graphene Application Note via info@laytec.de .

Crack free a-plane GaN layers with EpiCurve® TT AR

It is known that some properties of GaN based light emitting quantum wells (QW) can be improved by a-plane III-Nitrides. However, during the hetero-epitaxial growth on r-plane sapphire substrates, a-plane GaN layers are tensely strained in the growth plane resulting in crack formation. To achieve thick crack free a-plane GaN buffer layers, low temperature AlN interlayers (LT AlN IL) are used for strain engineering [1].

At the annual conference of the German Society for Crystal Growth (DGKK) last December, Matthias Wieneke of Otto-von-Guericke University in Magdeburg (Germany) reported about the impact of LT AlN IL on a-plane GaN films. For the studies, his team applies EpiCurve® TT AR – an in-situ metrology system with advanced curvature resolution (AR). This tool uses three laser spots for the curvature measurements (see the photo in Fig. 1) and, therefore, provides information also on wafer curvature asymmetry along two perpendicular directions as it is typical for a-plane III-N growth.

The in-situ curvature measurements are demonstrated in Fig. 1 by a red line for (spherical) curvature and a blue line for curvature asphericity. During the growth of the tensely strained a-plane GaN buffer layer, the curvature (red) increases, while it decreases after the insertion of LT AlN IL. Thus, the interlayer reduces the tensile strain as in the case of c-plane GaN growth. However, after the growth of the interlayers, the asphericity (Fig. 1 blue) increases, which indicates an increase of anisotropic strain. This anisotropy has been proven by subsequent ex-situ X-ray diffraction measurements [2].

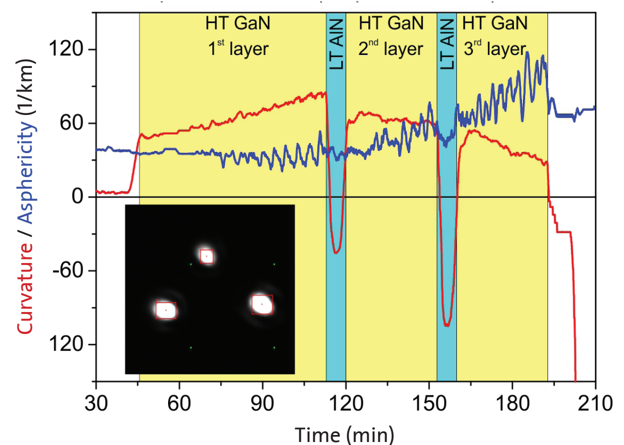

Fig. 1: In situ curvature measurements with EpiCurve® TT AR of a-plane GaN samples containing two LT AlN ILs [2].

Matthias Wieneke commented: "By measuring the aspheric bow component quantitatively with EpiCurve® TT AR, our team obtains additional real-time information on a-plane layer formation. It was definitely worth it to further develop the EpiCurve® tool." For further information please visit www.laytec.de/epicurve or contact info@laytec.de.

[1] M. Wieneke et.al., abstract book ICMOVPE 2012
[2] M. Wieneke et al., abstract book DGKK 2013

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

2 – 6 March 2014 | IS on Advanced Plasma Science and its Applications for Nitrides and Nanomaterials | Nagoya, Japan | www.isplasma.jp

16 – 20 March 2014 | SEMICON China 2104 | Shanghai, China | http://semiconchina.semi.org

18 – 19 March 2014 | CS International | Our talk: Advanced in-situ Growth Monitoring for GaN based Power Electronics on Silicon | Frankfurt on the Main, Germany | http://cs-international.net