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S E M I N A R
on
Semiconductor Physics and Nanotechnology

Di, 28.06.2022, 11:15 Uhr,

Seminar in
person in the Physics lecture hall *or* via Zoom

"Stress engineering in AlGaN stacks for HEMTs"

Prof. Dr. David Rafaja, Institute of Materials Science, TU Bergakademie Freiberg

Gallium nitride is a direct band gap semiconductor with a wide energy gap (~3.4 eV at 300 K), with a high critical electric field (3 MV/cm) and with a high heat conductivity (200 W/m/K). These properties qualify GaN for use as a key material in high-frequency transistors, in high-power devices and in numerous optoelectronic applications.

As the GaN single crystals are often grown in form of thick films on foreign substrates, a general challenge of the GaN single crystal production is the need of reducing the density of microstructure defects that are induced by the lattice misfit between the substrate and the GaN film. A specific issue arising when GaN is used for fabrication of the high electron mobility transistors (HEMTs) is the need of creating certain depth profile of the lattice strain, which is required for additional polarization of the semiconductor and for production of a thin channel guiding two-dimensional electron gas (2DEG).

In this talk, a micromechanical model will be presented that can be used for tailoring of the lattice strain profile in a stack of (001)-oriented AlxGa1-xN layers having different chemical compositions and thicknesses. Furthermore, this contribution will illustrate the applicability of the reciprocal space mapping using coplanar X-ray diffraction for the determination of the residual stresses and densities of threading dislocations in individual layers of the AlxGa1-xN stack. Finally, it will be demonstrated, how the combination of the stress profile prediction with the experimental information about the residual stresses and threading dislocation densities obtained from the XRD analysis can be applied to identify the mechanisms of the lattice strain reduction.

Zoom – Link:

https://zoom.us/j/95304293247?pwd=VWZaY3R5U1B0N0F3MExqMlg2bVlsQT09

Meeting-ID: 953 0429 3247

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