

TOWARDS AUTOMATED ANALYSIS OF X-RAY RECIPROCAL SPACE MAPS FOR THE CHARACTERIZATION OF GAN BASED HETEROSTRUCTURES

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Research efforts continue on the development of GaN based band gap engineered materials which find applications in HEMTs or LEDs. These devices contain epitaxial layered structures of increasing complexity. X-ray diffraction is one of the basic analytical methods that is routinely utilized for both materials research and quality control in production. X-ray scattering methods are non-destructive and deliver very detailed structural information on epitaxial layers and substrates including strain, strain relief, film thicknesses, crystalline quality and mosaic spread.

Maps around reciprocal lattice spots (RSM) can reveal additional information beyond that provided by single line scans such as high-resolution rocking curves. RSMs are typically used to aid the interpretation of peak displacement, peak broadening or peak overlap. However, they are considered too time consuming to collect and therefore are not frequently used.

Recent advances in X-ray area detector technology combined with smart positioning algorithms and data processing allow now RSMs to be recorded in similar timescales as rocking curves. These high-speed measurements find applications in the characterization in all crystalline advanced materials. Position sensitive detectors allow collecting many points at once and can be used in continuous mode, so less measurement and positioning steps are necessary to build up a given area of reciprocal space.

This contribution will discuss opportunities and limitations of this technique in conjunction with a feasibility study about automatic evaluation of RSM data from GaN based heterostructures. A fully automated workflow enables new possibilities of X-ray metrology in even high-throughput production environments.

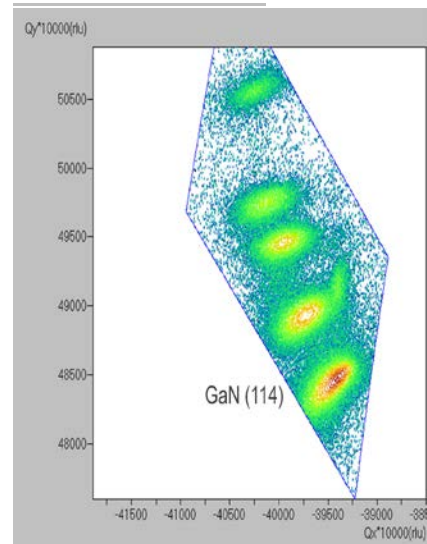


Fig. 1 Ultra-fast RSM collected in 30 seconds on a AlGaIn/ GaN HEMT structure on Si (111)

Keywords: High-resolution X-ray diffraction; Reciprocal space map; GaN