SESSION 7: GaN GROWTH & CHARACTERIZATION

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Since Nakamura's demonstration of the feasibility to establish a p/n-junction in wide band-gap GaN, new and different designs of material compositions and hetero-junctions for related compounds have demonstrated to open new pathways, whether being applicable for electronics or opto-electronics, and being possible for this direct material system due to, besides others, the controllability of band-gap engineering covering the range between 0.7 eV (InN) and 6.2 eV (AlN). This session will provide an update on some recent investigations.

The first presentation, by University of Fukui in conjunction with Japan R&D Center for Metal, Sharp Corporation, and Sumitomo Electric Industries explains that for HEMTs, the use of an AlGaN channel as part of the growth on free-standing AlN substrates, comparing it with standard AlGaN/GaN-HEMT on Si, is advantageous regarding high-temperature dependency of drain current degradation, on-state resistance, and threshold voltage, as well as reveals a one order of magnitude lower leakage current.

Initiatives to counter global warming strongly support switching lighting from conventional devices to GaN-based LEDs. AIXTRON will show that MOCVD growth of LED structures on 6 inch diameter sapphire substrates, as a strong request for cost reduction against growth on 2 inch, 3 inch, and 4 inch diameters before, can be achieved in an production environment, based on horizontal flow technology, speeding up process development, and time-to-market through simulation upfront, as well as using in-situ curvature measurement.

To establish and maintain device performance of HEMTs regarding thermal resistance, it is insufficient to only look on those parameters of the materials used. The University of Bristol will guide us to Benchmarking of Thermal Resistance of the GaN-SiC interface for AlGaN/GaN devices on SiC substrates. The importance examining this will be demonstrated, comparing the results from investigations on materials from various suppliers, from both industry and R&D.

To take advantage of lower contact resistance and better electron confinement, as a requirement for ultra-high speed applications, University of California, Santa Barbara explored N-polar orientation GaN HEMTs allowing now re-growth of InP by MBE for the formation of an ohmic contact to metal, different than for standard Ga-polar. Further process fine-tuning, including the insertion of an InGaN graded layer between GaN and InN led to a HEMT device featuring a record low ohmic contact resistance value.

Poster Presentation:

Increase in diameter for epi-wafers as the starting material for the production of GaInN LEDs, has been the request from the beginning due to two major reasons: cost reduction for final device and compatibility with Si-technology. 200 mm diameter sapphire substrates were used for the growth of a generic LED structure in a vertical flow regime MOCVD system, taking advantage of in-situ tools for measurements of wafer curvature, as well as precise temperature profile across the wafer susceptor. Promising results for substrates made from sapphire and silicon.