Polycrystalline Gallium Nitride thin film and bulk for highly efficient devices: A new process and approach

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Interest in polycrystalline gallium nitride (GaN) material is driven by rapid development of IIIV nitrides-based devices despite of its inevitable notorious formation of grain boundaries. As compared to its single crystal counterpart, polycrystalline GaN can be produced in variety of size through simple and cost-effective means. By producing the material in bulk, it could serve as a native substrate for GaN based devices of various sizes.

This work will present a new way of producing polycrystalline GaN thin film using a combined technique of e-beam evaporator with a successive ammonia annealing. The role of patterned substrate with different profile and the effect of annealing parameters on the surface and crystalline quality of the thin film will be discussed. The results from these experiments have been used as the input to produce a freestanding flat bulk polycrystalline GaN with a thickness of 50µm using the same producers as above and followed by a wet chemical etching for the substrate removal. The surface of the freestanding bulk sample is 2 times smoother than commercial ones. Our group has also successfully demonstrated a freestanding patterned polycrystalline GaN for the first time.

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