

## **Preparation and properties of bulk aluminum nitride (AlN) crystals and substrates**

Matthias Bickermann\*

Leibniz-Institute for Crystal Growth, Max-Born-Strasse 2, 12489 Berlin, Germany;

\*corresponding author, phone +493063923047, fax: +493063923003,

email: matthias.bickermann@ikz-berlin.de

Wafers cut from aluminum nitride (AlN) bulk single crystals are most promising substrates for deep UV optoelectronic or power electronic devices based on high Al content AlGa<sub>N</sub> epitaxial layers, due to their chemical stability, low thermal and lattice mismatch, and compressive strain to AlGa<sub>N</sub> layers. AlN bulk crystal growth is performed by physical vapor transport at temperatures of about 2200°C. We will present our status and progress in AlN bulk crystal growth on N-polar basal plane AlN seeds prepared from spontaneously nucleated freestanding AlN crystals. The crystals show excellent structural quality which is inherited in subsequent seeded growth runs. The current technological challenges, enabling efficient single-crystalline diameter enlargement as well as preventing seed backside evaporation, crystal cracking, and parasitic nucleation adjacent to the seed, are discussed in the presentation.

Optical and electrical properties of AlN substrates are critical for their application. Residual impurities such as C, O, and Si, as well as intrinsic defects, do not only govern the materials properties, but also influence crystal growth. We will present means to control impurity content during growth and to influence optical properties by compensation and Fermi level effects. Finally, we show examples of proper surface preparation, MOVPE growth results, and first AlGa<sub>N</sub>/AlN test devices.