Technological considerations for seeded AlN bulk growth

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Single-crystalline diameter enlargement in conjunction with improvement (or at least, perpetuation) of crystal structural quality is only possible with homoepitaxial bulk growth on AlN seeds. However, the availability of native seeds is only one precondition on the way to perfect AlN single crystals.

A seeding procedure which preserves the seed quality during bulk growth has to master challenging tasks, such as seed mounting, backside evaporation, prevent crystal cracking, enable a soft growth start, and avoid parasitic nucleation.

In this presentation, we will discuss technological solutions for some of these issues and present our latest results in growth of “free-standing” AlN bulk crystals with very low defect density grown on AlN seeds. In particular, the following topics will be addressed:

- growth and structural properties of big, spontaneously nucleated and freestanding grown AlN crystals from which low defect AlN seeds are prepared,
- impact of seed surface pre-treatments and thermal gradient inversion during heating-up on soft growth start and defect formation,
- avoiding parasitic growth adjacent to the AlN crystal by designing and implementing a radiation shield around the seed with assistance by numerical modelling, and
- structural defect status of homo-epitaxial grown AlN crystals as studies by wet chemical etching, XRD rocking, and X-ray topography,
- strategies for diameter expansion.

Fig. 1: AlN bulk crystals grown in contact to poly-crystalline ambient (left) and without parasitic deposition (right). The X-ray rocking curve FWHM (with open detector) of the crystal on the right is 13 arcsec.