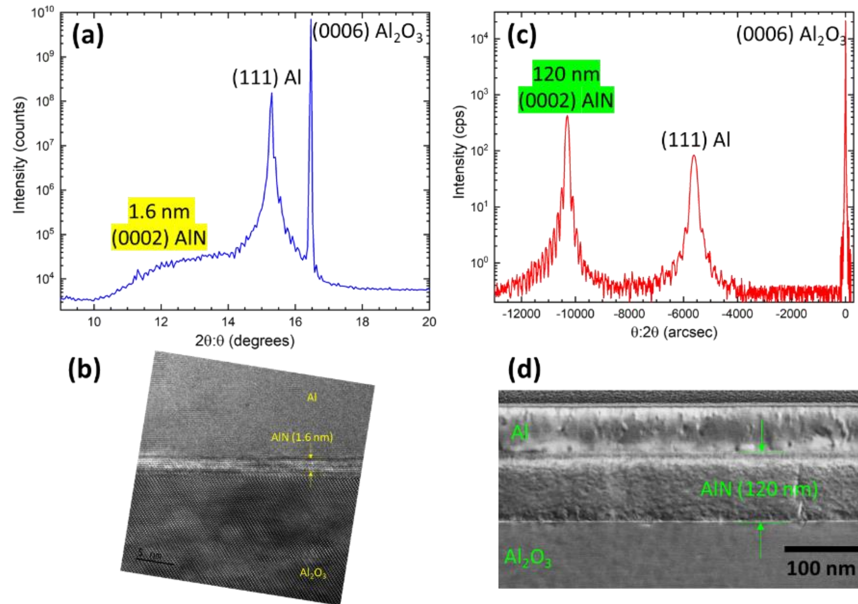

Figure 1. (a) Synchrotron X-ray 2θ:θ symmetric measurement using 20 keV X-ray energy and (b) cross-sectional high-resolution transmission electron microscopy image of the nitrided sapphire prior to AlN growth (capped with Al). The initial AlN thickness is ~1.6 nm and is (0001) oriented. (c) Laboratory X-ray θ:2θ symmetric measurement using 8.05 keV (Cu Kα_1) after 120 nm of AlN growth (d) [0002] AlN two-beam scanning transmission electron microscopy (STEM) bright field image.

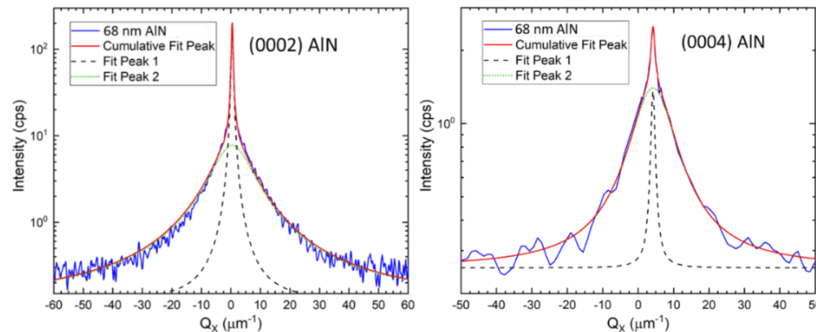

Figure 2. Triple axis X-ray diffraction symmetric (0002) and (0004) AlN rocking curves after 68 nm of AlN growth. Both rocking curves consists of two components: (1) narrow peak corresponding to lattice tilt of ~30” and (2) broad peak corresponding to lateral coherence length of ~75 nm.

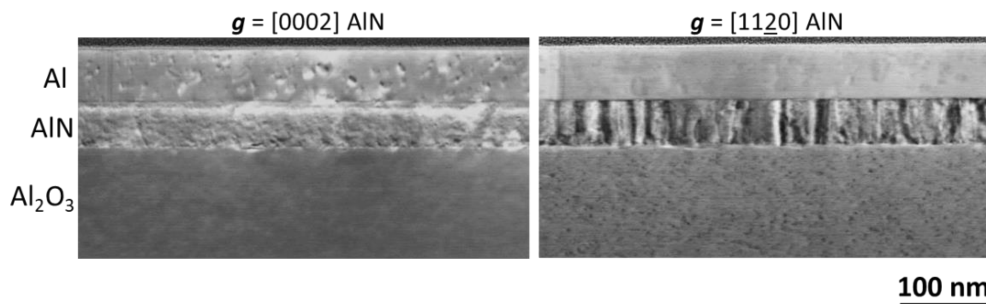

Figure 3. Cross-sectional STEM bright field images using [0002] and [11$\underline{2}$0] AlN two-beam condition after 68 nm of AlN growth. There is no evidence of inversion domains, which would appear in the [0002] AlN two-beam STEM image. A columnar structure is only observable under the [11$\underline{2}$0] condition, which is indicative of the boundaries exhibiting an edge component or character.