HRTEM observation of grain boundaries of AlN sintered ceramic

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1. Check the image of the grain boundary at lower magnification (typically X100K) in BF mode and tilt about an axis of the boundary parallel to electron beam, obtain a relatively sharp "minimum" in the width of the boundary. It is fast and allows eliminating those GBs that are far away out of orientation, but needs to use a large angle double tilt holder.

2. Once finding what seemed to be a suitable GB, then at that point, check the diffraction pattern to see if there were any Kikuchi lines (from either grain) that were parallel to the grain boundary and which corresponded to reflections that could be used for HRTEM imaging (i.e. large enough d-spacing).

3. If that is the case, then tilt the sample along that Kikuchi line (i.e. maintaining that set of reflections for that particular grain) and at the same time check the DP from the other grain until a suitable orientation was attained for that second grain.

4. More often than not, move on to another location and start the whole operation again until all three elements (Grain 1, grain 2 and the GB) had the proper orientation.

5. In most instances the images consisted of two beam conditions, but that was sufficient to resolve the GBs, and learn the grain boundary states.

Reference: D.R. Clark, Ultramicroscopy 4 (1979) 33-44

Low-index planes of AlN ceramic

AlN is a covalently bounded material with a hexagonal wurtzite structure. It belongs to the P63mc space group, and with the lattice parameters a = 0.31114 and c = 0.49792 nm according to JCPDS (25-1133).

K	U	V	W	H1	K1	L1	H2	K2	L2	R2/R1	R3/R1	FAI	D1	D2
1	0	0	1	0	-1	0	1	0	0	1.000	1.000	120.00	2.695	2.695
2	1	2	1	-1	0	1	1	-1	1	1.000	1.296	99.22	2.370	2.370
3	2	4	1	1	-1	2	1	0	-2	1.000	1.175	108.01	1.829	1.829
4	1	1	1	-1	1	0	0	-1	1	1.137	1.137	116.09	2.695	2.370
5	2	3	1	1	-1	1	1	0	-2	1.296	1.596	92.93	2.370	1.829
6	2	2	1	-1	1	0	0	-1	2	1.474	1.474	109.83	2.695	1.829
7	1	2	2	0	-1	1	2	-1	0	1.523	1.822	90.00	2.370	1.556
8	1	1	0	0	0	-1	-1	1	0	1.848	2.101	90.00	4.979	2.695
9	1	2	0	0	0	-1	-2	1	0	3.201	3.353	90.00	4.979	1.556