

Suitable thickness of the adhesive layer facilitates the release of thermal stresses in AlN crystals

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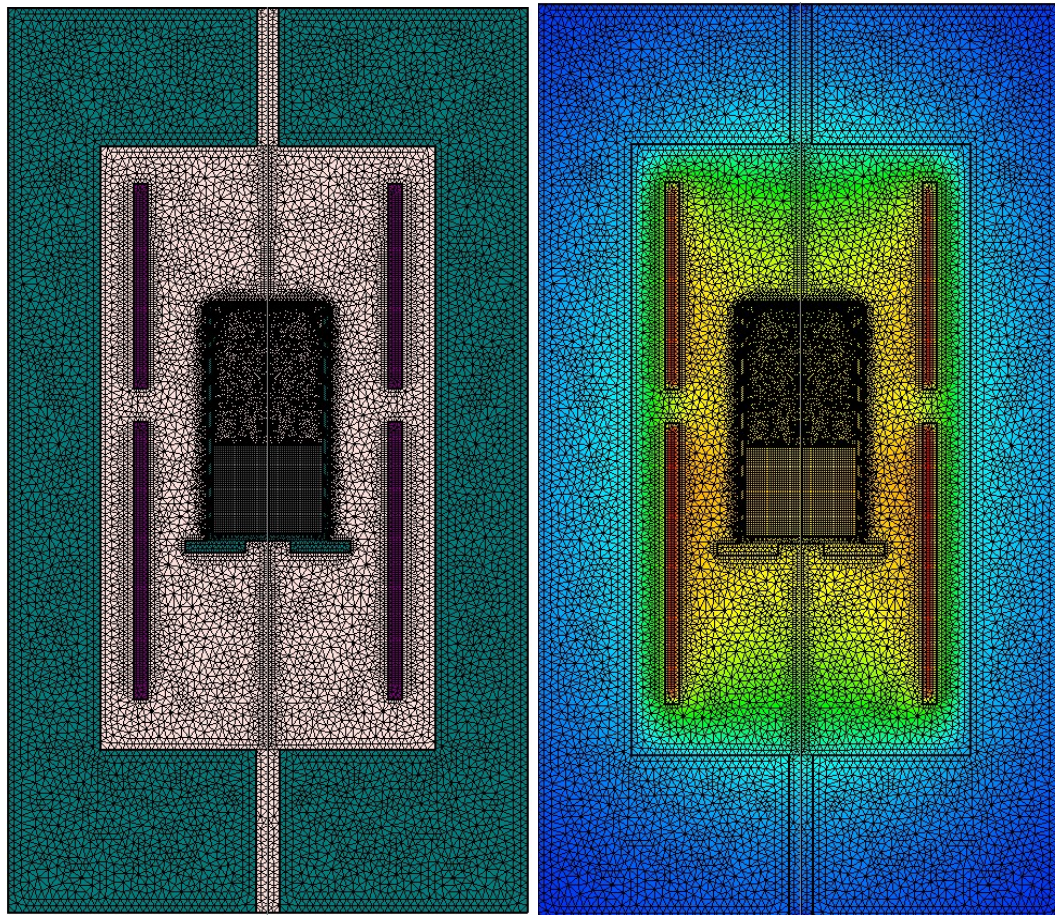
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Modeling Details

As an example, the parameters of a conventional crucible are as follows :



Glue Thickness [mm]	0.1	Glue Thickness [mm]	0.4
Glue Activation Energy [J/kmol]	1E+07	Glue Activation Energy [J/kmol]	1E+07
Glue Relaxation Time [h]	5	Glue Relaxation Time [h]	5
Glue Shear Stress Module [GPa]	1	Glue Shear Stress Module [GPa]	1
Glue Thickness [mm]	0.8	Glue Thickness [mm]	1
Glue Activation Energy [J/kmol]	1E+07	Glue Activation Energy [J/kmol]	1E+07
Glue Relaxation Time [h]	5	Glue Relaxation Time [h]	5
Glue Shear Stress Module [GPa]	1	Glue Shear Stress Module [GPa]	1

Figure S1. Modeling detail display of the conventional crucible

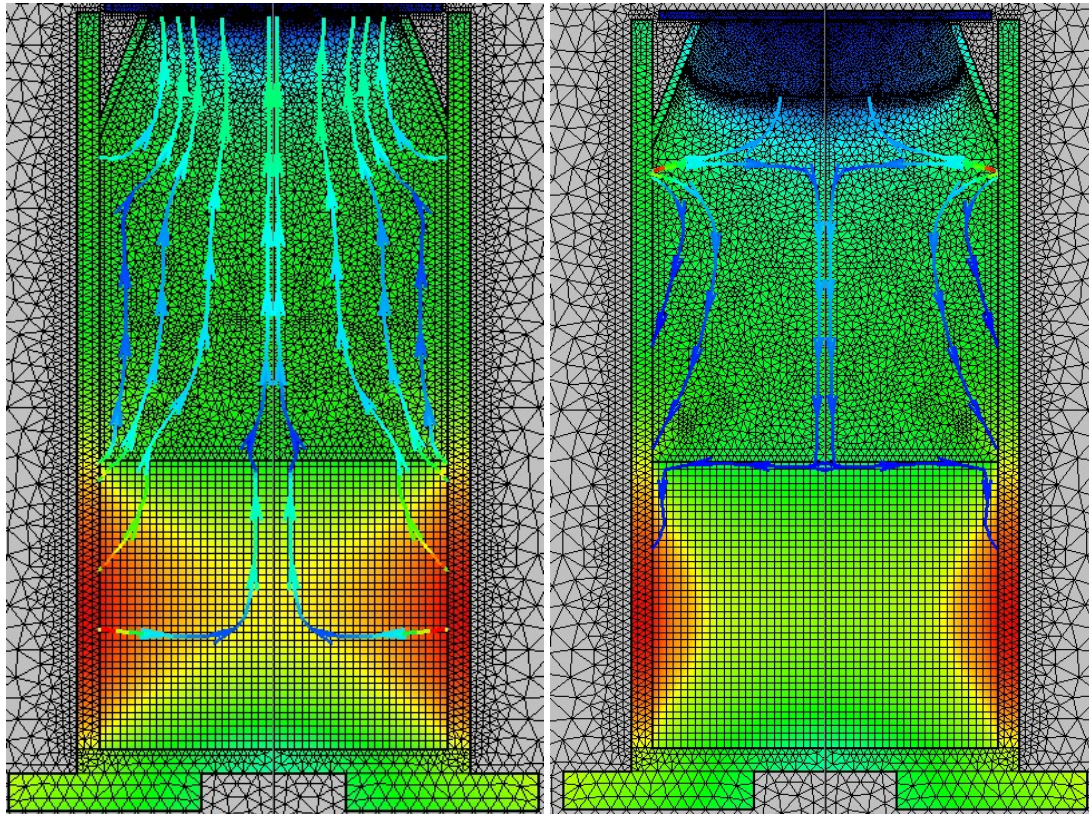


Figure S2. Gas transport pathways at the beginning and end of the growth period

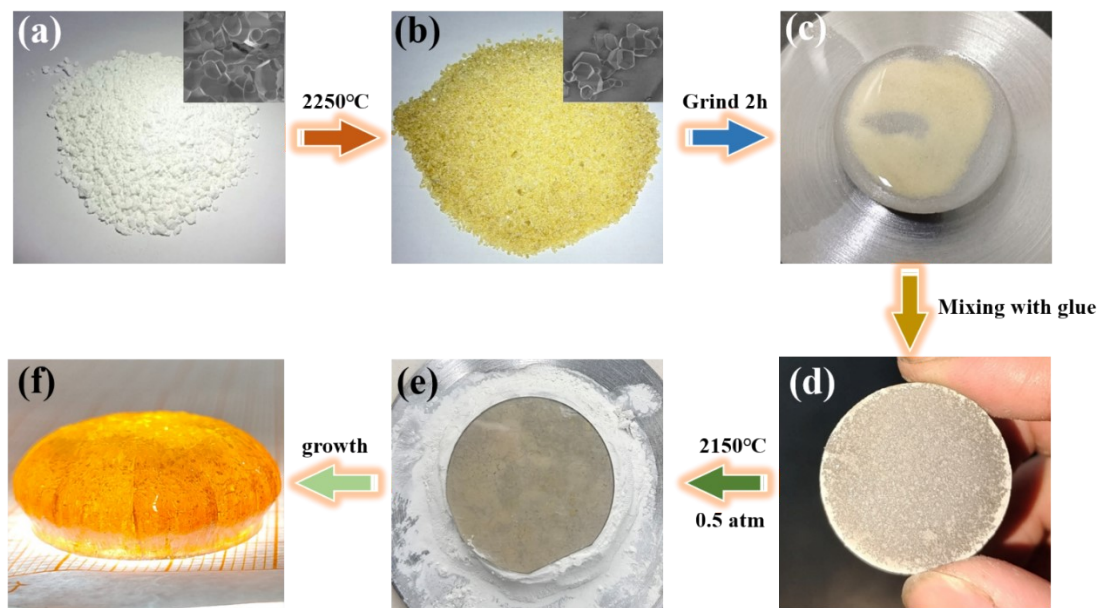


Figure 3. (a) AlN powder and SEM characterization; (b) The source AlN powder and SEM characterization after high-temperature sintering; (c) The pictures of the bonding process; (d) Graph of mixing the powder with adhesive; (e) Photo of seed crystal after bonding; (f) Pictures of crystals after growth.

Process of Sample Preparation

Take 100g of AlN powder (Fig. S3a) and put it into the reactor for sintering, the sintering temperature is 2250°C, and the sintering time is 12h, to form the crystalline AlN powder (Fig. S3b), take 5-10g of it and grind it for 2h, then use the alcohol as the dispersing agent to make it spread on the tungsten holder (Fig. S3c), and add 5-10g of inorganic adhesive and mix it, put the seed crystal on it, and then put it into the reactor at 200°C and low-temperature sintering for 5h to make the adhesive layer solidify (Fig. S3d), then put the tungsten holder with bonded seed crystals into the reactor, raise the temperature to 2150°C, the pressure is 0.5 atm, and sinter them for 12h and take them out (Fig. S3e), then conduct the crystal growth experiments to verify the validity of the bonding (Fig. S3f).

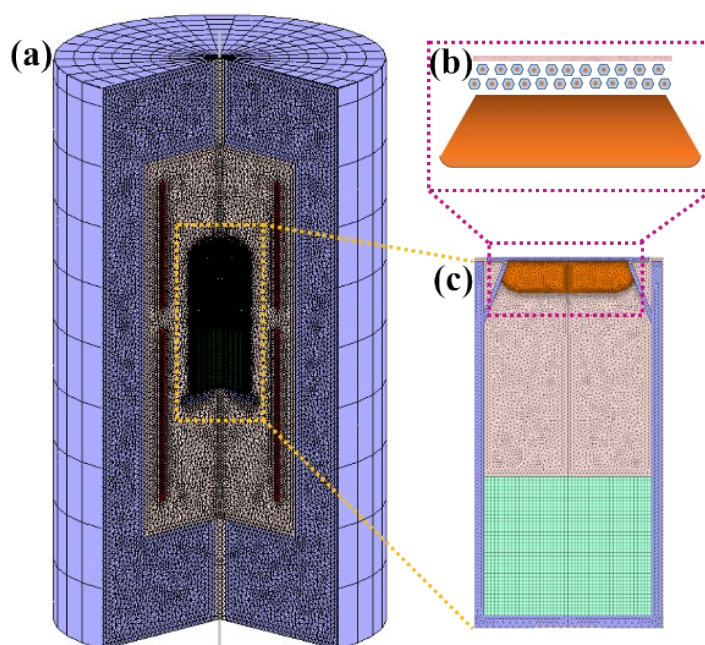


Figure S4. (a) 3D model of the temperature field of the heating system for double-resistive AlN crystal growth; (b) Schematic diagram of the role of the bonding agent; (c) Mesh model of the crucible structure;

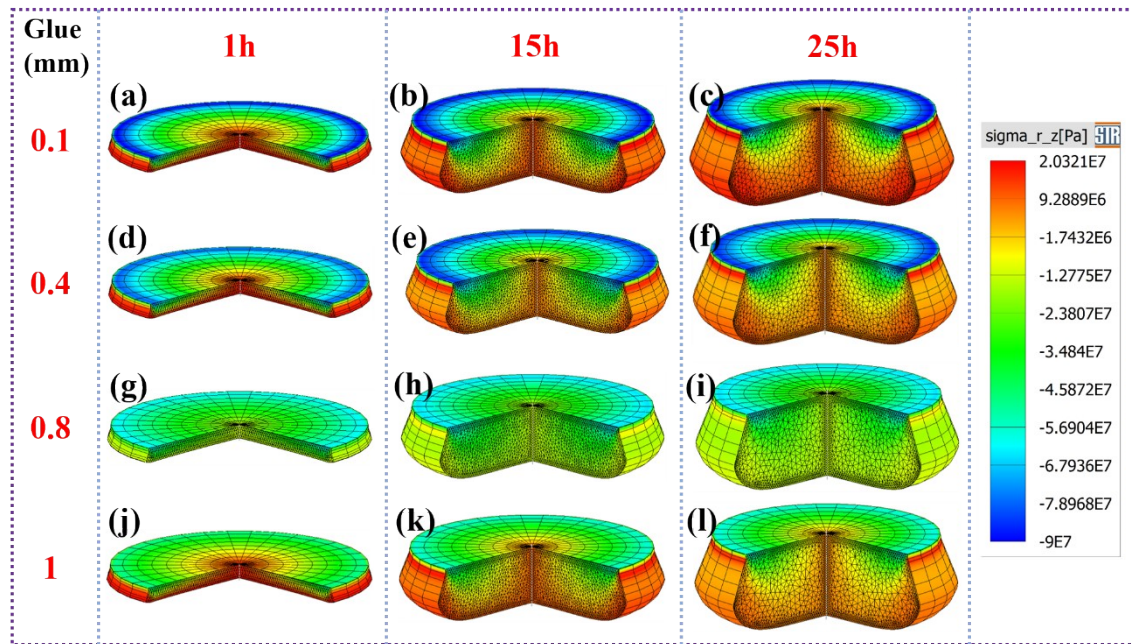


Figure S5. (a-l). Vertical shear stress distribution for different conditions

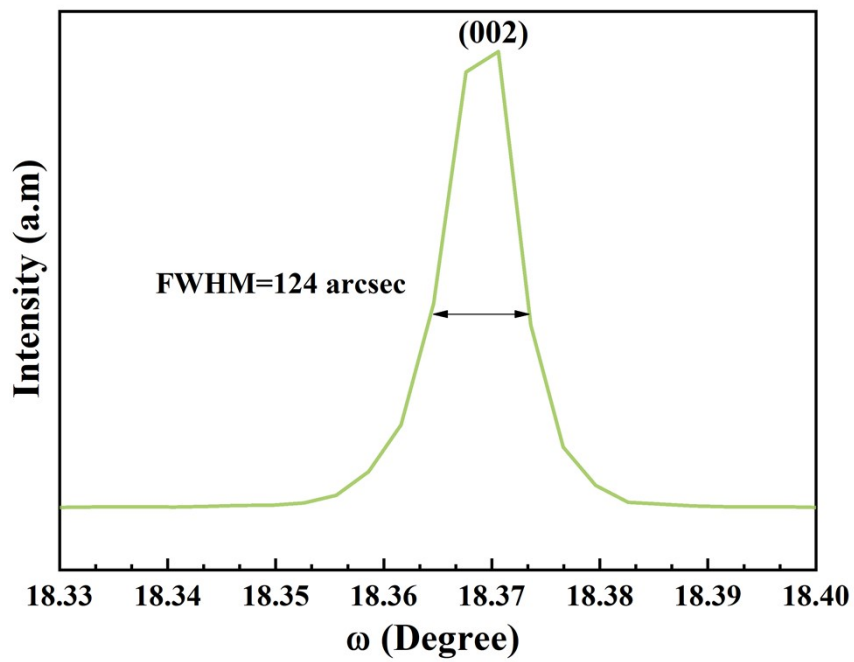


Figure S6. HRXRD of AlN wafers grown at an adhesive thickness of 0.8 mm