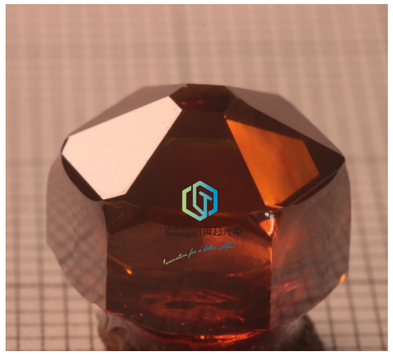
Standard specifications of M-plane AlN substrate

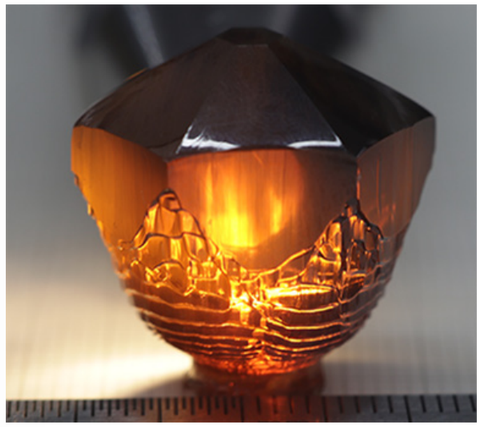
At present, Ultratrend Technologies Co., Ltd. (UTC) can provide 10x10mm/Φ10mm/Φ15mm/Φ20mm/Φ25.4mm/Φ30mm/Φ50.8mm standardized and 10-20mm non-polar m-plane, 5-60 mm tailored high-quality AlN single crystalline wafers, which are ideally suited as substrate for UVC-LED, UV lasers, UV detectors and high-power, high-temperature, high-frequency electronic devices, etc..



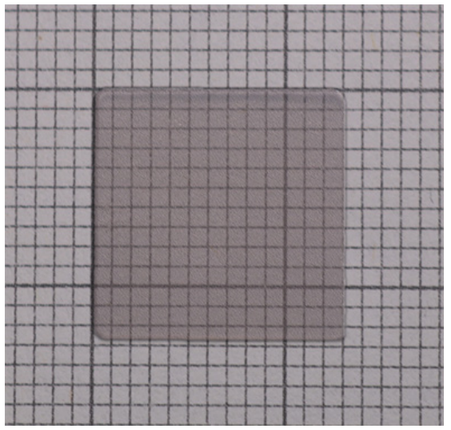
Characteristic	Specification		
Product Serial	UTI-AlN-MB		
Size	10mm-20mm		
Thickness (μm)	400 ± 50		
Crystal type	2H		
Orientation	{10-10}± 1°		
Surface Finish	Al face: CMP (double side polishing is customizable)		
Roughness	Al face: ≤0.5 nm N face (backside): ≤1.2 um		
Shape	Rectangular		
Grade	S (Super)	P (Production)	R (Research)
FWHM-HRXRD@(10-10) (arcsec)	≤300	≤700	≤1000
Absorption Coefficient@265nm (cm^{-1})	≤50	≤70	≤100
Edge Exclusion (mm)	1	1	1
Scratches	None	None	None
Edge Chips	None	None	≤3 total cumulative length≤1.0 mm
Usable Area	≥90%		
TTV (μm)	≤ 30		
Bow (μm)	≤ 30		
Wrap (μm)	≤ 30		
Cracks	None ,by naked eye ,high intensity light		
Surface Contamination	None ,by naked eye ,diffuse light		
Packaging	Single wafer cups		

Note: Test results for these speifications are slightly different depending on equipments and/or software

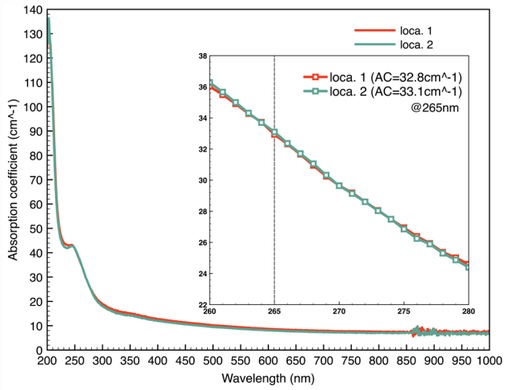
Characterization results of AlN substrate



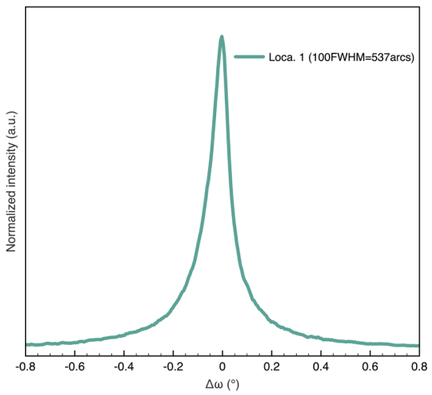
AlN single crystalline boule



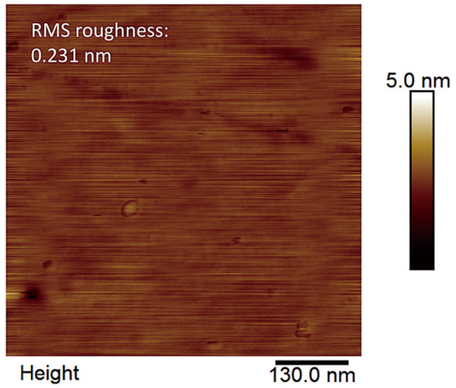
M-plane AlN single crystalline substrate



UV absorption coefficient



X-ray rocking curves in the 10-10 reflection



Morphologies of polished surface after CMP by AFM

Applications of AlN substrates

Silicon-based semiconductor technology has reached its limits and could not satisfy the requirements of future electronic devices. As a typical kind of 3rd/4th-generation semiconductor material, aluminum nitride (AlN) has superior physical and chemical properties such as wide bandgap, high thermal conductivity, high breakdown filed, high electronic mobility and corrosion/radiation resistance, and is the perfect substrate for optoelectronic devices, radio frequency (RF) devices, high-power/high-frequency electronic devices, etc.. Particularly, AlN substrate is the best candidate for UV-LED, UV detectors, UV lasers, 5G high-power/high-frequency RF devices, which could widely be used in environmental protection, electronics, wireless communications, printing, biology, healthcare, military and other fields, such as UV purification/sterilization, UV curing, photocatalysis, counterfeit detection, high-density storage, medical phototherapy, drug discovery, wireless and secure communication, aerospace/deep-space detection and other fields.

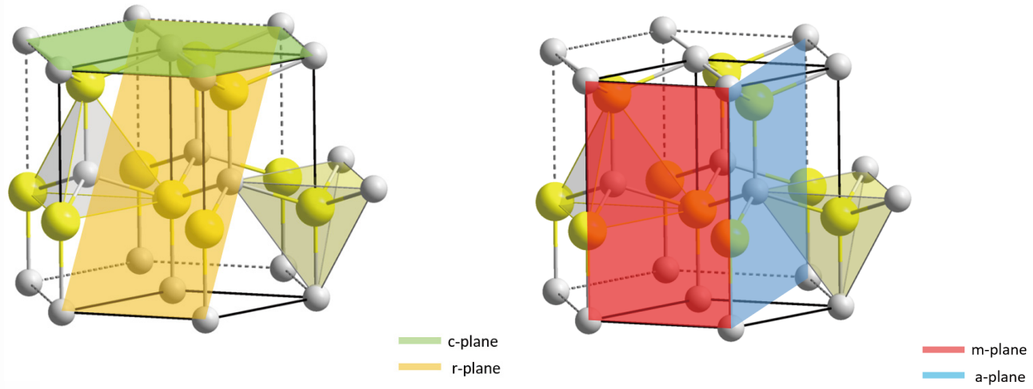
The Physical Vapor Transport(PVT) method has been shown to be the only promising growth technique for high-quality and large-size bulk AlN crystals. UTC has developed a serials of proprietary processes and technologies to grow high-quality AlN single crystalline boules by the PVT method, and has been recognized as a global leader in this field.

Major impurities :

Element	C	O	Si	B	Na	W	P	S	Ti	Fe
PPMW	27	90	5.4	0.92	0.23	<0.1	<0.1	<0.5	0.46	<0.5

Major impurities measured by GDMS and EGA

AlN crystal structure



Wurzite-type AlN crystal structure with illustrated major planes

Properties of AlN substrate

Properties	Reference
Crystal structure	Wurtzite
Lattice constant (Å)	a=3.112, c=4.982
Conduction band type	Direct bandgap
Density (g/cm3)	3.23
Surface microhardness (Knoop test)	800
Melting point (℃)	2750 (10-100 bar in N2)
Thermal conductivity (W/m·K)	320
Band gap energy (eV)	6.28
Electron mobility (V·s/cm2)	1100
Electric breakdown field (MV/cm)	11.7
Acoustic wave velocity (m/s)	11,300