



NAPHIA™

**Industry-leading sapphire products for next-generation product
development and R & D**

ADAMANT *Namiki*

NAPHIA™ series

Adamant Namiki Precision Jewel has manufactured many sapphire substrates during today's era of LED adoption, and the crystal growth / cleaning / polishing technology we've cultivated through this has been further evolved for the next generation. We have developed the NAPHIA™ series (name derived from "Namiki Sapphire"), which is primarily suited for research and development of new semiconductor devices and can solve problems caused by substrates.

In addition to the conventional standard grade, we also offer prime grade, with a higher level of flatness and cleaning. Furthermore, with precision cleaning and re-polishing, it can be used repeatedly, contributing to a reduction in total cost.

NAPHIA™

Sapphire wafer

Standard grade
Prime grade

NAPHIA™

Career wafer Career tray

NAPHIA™

Optical flat lense cover

NAPHIA™

Heat resistant/dissipation sapphire

NAPHIA™ **Contract processing**

(Re-polishing / cutting /
precision cleaning/ measurement)



Adamant Namiki's single-crystal sapphire growth method

We manufacture single-crystal sapphire by pulling it into a plate shape using the EFG method (Edge-defined Film-Fed Growth). By pulling up sapphire into a plate shape, the cutting process required in general ingots manufacturing is unneeded, so it is possible to support various plane orientations and provide highly accurate sapphire substrates and products. In addition, this method can handle large substrates and various special shapes.

NAPHIA™ Sapphire Wafers

In addition to standard grade substrates for general LED use, we also offer high quality, prime grade wafers. The high quality cleaning applied to prime grade wafers results in low particles and low metal contamination(*) . (*) K,Ca,Ti,Cr,Mn,Fe,Co,Ni,Cu,Zn < 5E10 /cm² with TXRF

We control flatness (TTV,BOW,WARP, etc.) with precision manufacturing technology, and warpage problem that can occur during epitaxial growth is minimized.

The prime grade wafer is optimal for new process/product development.

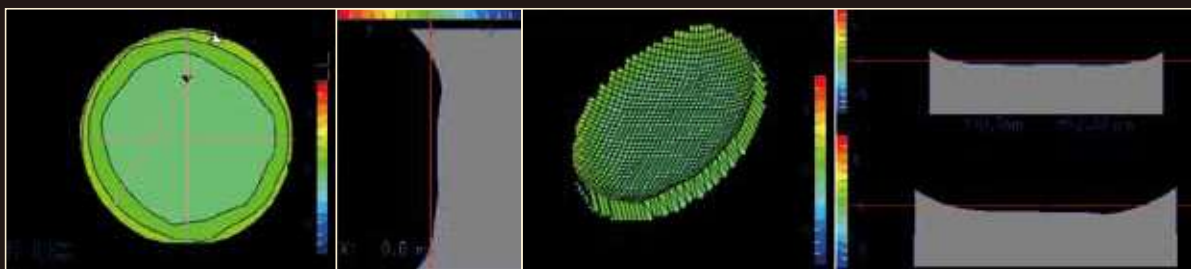
Application examples of prime grade wafer: micro-LED, DUV-LED, RF device, AlN/Ga₂O₃ template.

Item	Specification			
	φ 2inch	φ 4inch	φ 6inch	φ 8inch
Diameter	φ 2inch	φ 4inch	φ 6inch	φ 8inch
Material	Artificial sapphire (Al ₂ O ₃ ≥ 99.99%)			
Thickness	430±15μm	650±15μm	1300±20μm	1300±20μm
Surface orientation	c-plane (0001)			
OF length	16±1mm	30±1mm	47.5±2.5mm	47.5±2.5mm
OF orientation	a-plane 0±0.3°			
TTV*	≤10μm	≤10μm	≤15μm	≤15μm
BOW*	-10μm ~ 0μm	-15μm ~ 0μm	-20μm ~ 0μm	-25μm ~ 0μm
WARP*	≤15μm	≤20μm	≤25μm	≤30μm
Front side finishing	Epi-ready (Ra < 0.3nm)			
Back side finishing	Lapping (Ra 0.6μm - 1.2μm)			
Packaging	Vacuum packaging in clean room			
Prime grade	High quality cleaning : particle size ≥ 0.3μm, ≤ 0.18pcs/cm ² , metal contamination ≤ 5E10/cm ²			
Remarks	Customizable specifications: a/ r/ m-plane orientation, off-angle, shape, double side polishing			

*TTV (Total Thickness Variation): The difference between the maximum and minimum values of the wafer thickness

*BOW: The distance between the surface and the best fit plane at the center of an unclamped wafer

*WARP: The difference between the maximum and minimum deviations from the best fit plane (wafer unclamped)



High quality and services for next-generation semiconductor devices and epitaxial growth

- High flatness (controlled TTV, BOW, and WARP etc.)
- High quality cleaning (low particles, low metal contamination)
- Substrate drilling, grooving, cutting, and backside polishing
- Attachment of measurement data such as cleanness and shape of substrate. (optional)

Depending on the specs, we have inventory for 2 to 8inch, or 300mm diameter substrates.

Please contact us for any inquiries.

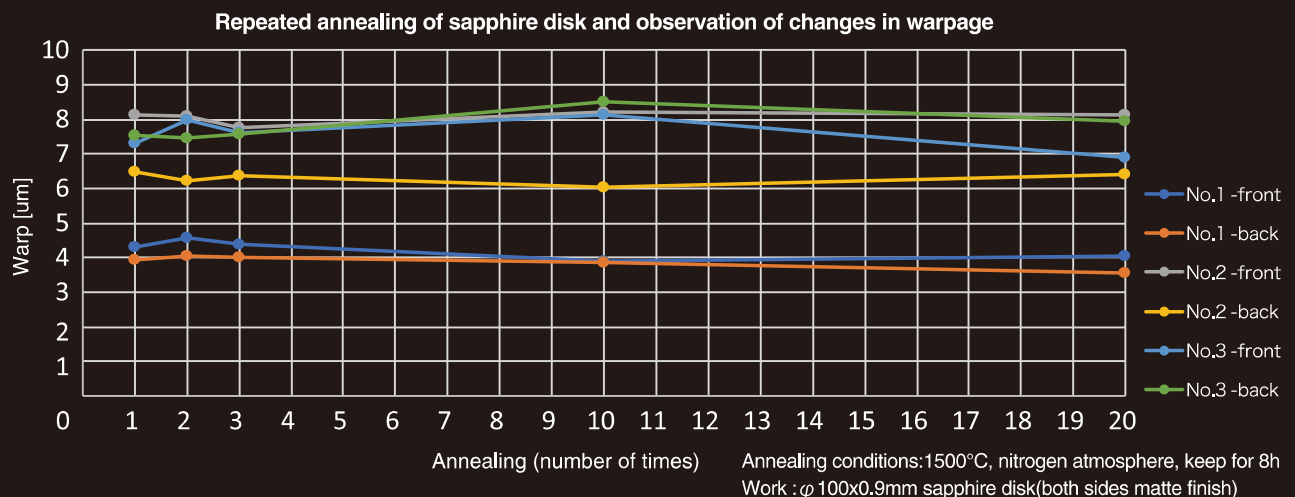
NAPHIA™ Career Wafers

NAPHIA™ sapphire is used as a carrier wafer in the semiconductor process. Utilizing the polishing technology we have cultivated over many years, we are now able to manufacture ultra-large support wafers and carrier plates up to 12 inches (ϕ 300mm). Additional processing such as drilling and grooving is available for all specifications, and our re-polishing and cleaning capabilities mean the wafer can be used repeatedly. Compared to glass / ceramics, sapphire does not have problems due to distortion and deformation or contamination from degassing, so it can be used without worrying about changes in process conditions. In addition, since sapphire is a material with excellent heat, chemical, and plasma resistance, it can be used in high-temperature processes and harsh environments.

Item	Specification				
Diameter	ϕ 4inch	ϕ 5inch	ϕ 6inch	ϕ 8inch	ϕ 12inch
Material	Artificial sapphire ($Al_2O_3 \geq 99.99\%$)				
Thickness	1±0.003mm				3±0.005mm
Orientation	c-plane (0001) / r-plane (-1012)				c-plane (0001)
OF	Flat / Notch / None				
TTV	$\leq 2.5\mu m$			$\leq 3.0\mu m$	
Front side finishing	Polish (Ra<0.3nm)				
Back side finishing	Polish (Ra<0.3nm)				
Remarks	Customizable specifications: thickness, orientation, single side polishing. Other options: drilling, laser marking, delivery by thickness classification, re-polishing				

NAPHIA™ Heat resistant/dissipation sapphire

Item	Specification					
Size	\square 25mm	\square 50mm	\square 75mm	\square 100mm	\square 125mm	\square 150mm
Material	Artificial sapphire ($Al_2O_3 \geq 99.99\%$)					
Thickness	1mm, 5mm, 10mm					
Orientation	c-plane (0001)					
Front side finishing	Polish (Ra<0.3nm)					
Back side finishing	Polish (Ra<0.3nm)					
Remarks	Customizable specifications: diameter, thickness, orientation, etc. Other options : re-polishing					



NAPHIA™ Optical Flat Lenses / Covers

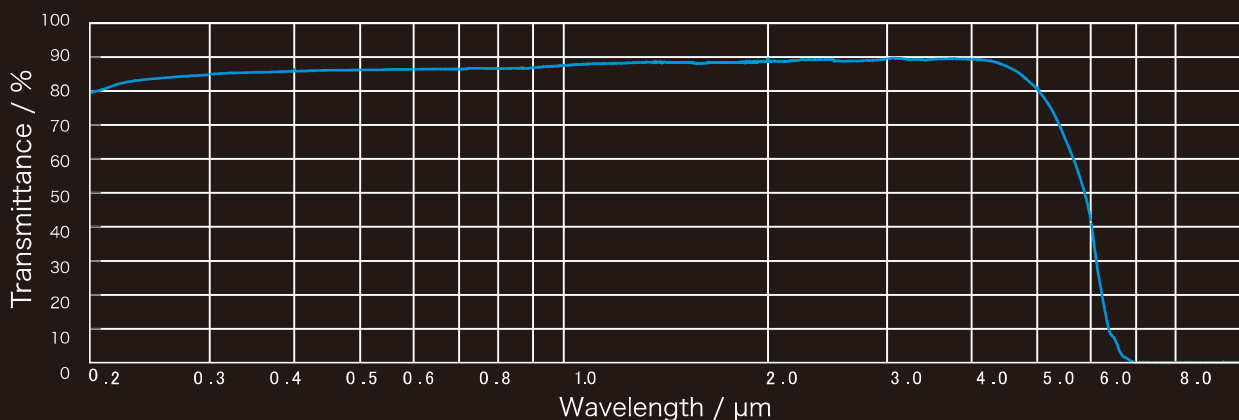
NAPHIA™ optical flat lenses / covers are optical windows and lenses that are ultra-precision processed in shape and flatness (indicated by λ) for small diameters such as ϕ 1mm to ϕ 3mm, and large diameters such as 300mm. Both circular and square shapes are available. If the thickness is 3mm or more, we can provide a higher degree of flatness.

Transparent materials with a small difference in height have advantages such as the ability to bond to different materials while maintaining flatness, and a more evenly transmission of light. Sapphire, as a transparent material, allows for clear visibility of the bonded surface, and can be used for visualization experiments. Additionally, sapphire in particular has unique features that can be leveraged, such as its high temperature resistance, excellent thermal conductivity, scratch resistance, and high durability.

Item	Specification						
Diameter	ϕ 1.5mm ~	ϕ 50mm	ϕ 75mm	ϕ 100mm	ϕ 125mm	ϕ 175mm	ϕ 200mm
Material	Artificial sapphire ($\text{Al}_2\text{O}_3 \geq 99.99\%$)						
Thickness	0.5mm ~	1mm, 5mm, 10mm					
Orientation	c-plane (0001)						
Front side finishing	Polish ($R_a < 0.3\text{nm}$)						
Back side finishing	Polish ($R_a < 0.3\text{nm}$)						
Remarks	Customizable specifications: diameter, thickness, orientation, etc. Other options: re-polishing						

Item	Specification						
Diameter	\square 1.5mm ~	\square 25mm	\square 50mm	\square 75mm	\square 100mm	\square 125mm	\square 150mm
Material	Artificial sapphire ($\text{Al}_2\text{O}_3 \geq 99.99\%$)						
Thickness	0.5mm ~	1mm, 5mm, 10mm					
Orientation	c-plane (0001)						
Front side finishing	Polish ($R_a < 0.3\text{nm}$)						
Back side finishing	Polish ($R_a < 0.3\text{nm}$)						
Remarks	Customizable specifications: diameter, thickness, orientation, etc. Other options: re-polishing						

Transmittance for c-plane sapphire (0.2~10 μm , ultraviolet ~ infrared)

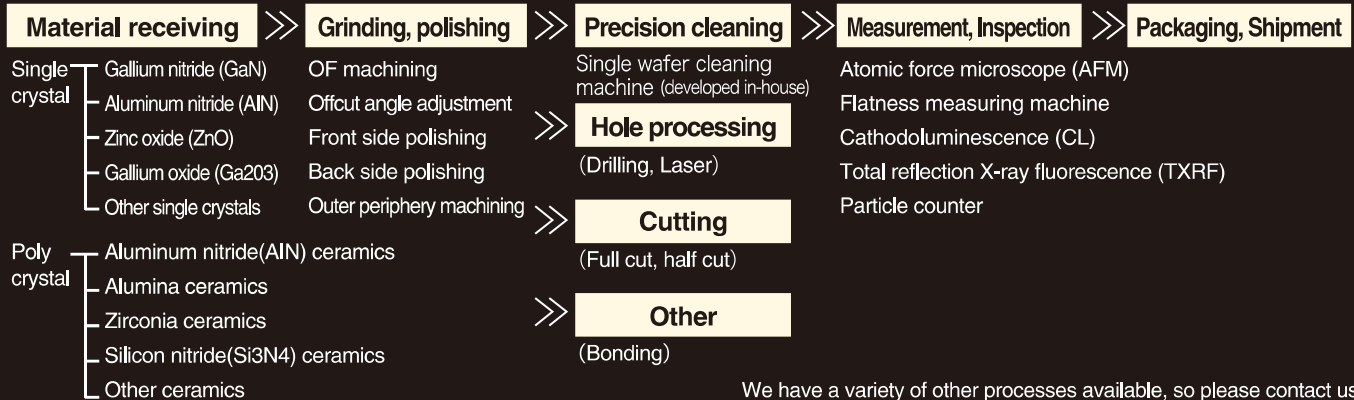


Sapphire provides even light transmittance across a wide range of wavelengths, and is widely used in harsh environments, such as for ultraviolet and infrared transmission windows and sensor covers. (We will respond to requests for lenses/covers according to customer' s required size and specifications such as λ to $\lambda/20$.) In addition, sapphire is widely used for the exterior and crystal of watches, and in recent years, has been increasingly adopted in exterior parts for smartphones, smart watches, and new product designs.

NAPHIA™ Contract processing

re-polishing/cutting/precision cleaning/measurement

Utilizing our polishing technology for high-hardness sapphire material, we accept contract polishing and grinding of various materials such as aluminum nitride (AlN) ceramics, alumina ceramics, and zirconia ceramics. In addition, we can polish single crystals such as gallium nitride (GaN), aluminum nitride (AlN), zinc oxide (ZnO), gallium oxide (Ga₂O₃), and yttrium aluminum garnet (YAG). Please feel free to contact us with any requests, as we can also process materials other than those listed. We also offer, fine hole processing (drilling / laser processing), bonding (atomic bonding), backside polishing, and full cutting or half cutting (groove processing). For single crystal materials, we support wafer processing such as orientation flat processing and off-angle adjustment.



Contract processing example

Processing	Processing equipment	Work		Processing accuracy
		Maximum size	Maximum thickness	
Cutting	Peripheral blade cutting machine	□200mm	5mm	±0.5mm
	Inner peripheral blade cutting machine	φ8inchL150mm	10mm	±0.1mm
	Wire cutting machine	φ8inchL300mm	3mm	±0.03mm
	Dicing machine	□150mm	1.5mm	±0.02mm
Surface grinding	Surface grinder	600x300mm	200mm	0.03mm
	Horizontal grinder	φ5inch	50mm	±0.01mm
	Vertical grinder	φ8inch	100mm	
	Double side lapping machine	φ12inch	30mm	
Outer periphery grinding	Cylindrical grinder	φ8inch	300mm	±0.01mm
	Centerless grinder	L150mm	20mm	
	NC lathe	φ12inch	Depends on the processing (please contact us)	
Surface polishing	Double side lapping machine (Diamond · CMP)	φ12inch	30mm	±0.005mm
	One side polishing machine	φ6inch	50mm	
Drilling	Micro drilling	φ12inch	10mm	±0.25mm
	Laser processing machine	φ6inch	See below	
Laser type	Minimum hole diameter	Minimum pitch	Accuracy	Maximum processing thickness
Femtosecond laser	φ0.05mm	0.08mm	±0.01mm	0.25mm
UV laser	φ0.23mm	0.5mm	±0.015mm	0.8mm

*Above is typical value. For customization, please contact us.

Information regarding products and technologies other than what's in this catalog is available on our website.

* We support a wide variety of processes, so please contact us with any questions or specific requests.

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