TANKEBLUE

TanKeBlue

Semiconductor Co., Ltd.

Silicon Carbide Substrates

Product Specifications

4H N-Type
6H N-Type and 6H Semi-insulating

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SILICON CARBIDE MATERIAL PROPERTIES

Property	4H-SiC, Single Crystal	6H-SiC, Single Crystal
Lattice Parameters	a=3.076 Å c=10.053 Å	a=3.073 Å c=15.117 Å
Stacking Sequence	ABCB	ABCACB
Mohs Hardness	≈9.2	≈9.2
Density	3.21 g/cm^3	3.21 g/cm^3
Therm. Expansion Coefficient	4-5×10^{-6}/K	4-5×10^{-6}/K
Refraction Index @750nm	n_o = 2.61 n_e = 2.66	n_o = 2.60 n_e = 2.65
Dielectric Constant	c~9.66	c~9.66
Thermal Conductivity (N-type, 0.02 ohm.cm)	a~4.2 W/cm·K@298K c~3.7 W/cm·K@298K	
Thermal Conductivity (Semi-insulating)	a~4.9 W/cm·K@298K c~3.9 W/cm·K@298K	
Band-gap	3.23 eV	3.02 eV
Break-Down Electrical Field	3-5×10^6V/cm	3-5×10^6V/cm
Saturation Drift Velocity	2.0×10^5m/s	2.0×10^5m/s

Applications

III-V Nitride Deposition

Optoelectronic Devices

High-Power Devices

High-Temperature Devices

High-Frequency Power Devices

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天科合达 2 英寸 SiC 晶片产品标准

2 inch diameter Silicon Carbide (SiC) Substrate Specification

等级 Grade		工业级 Production	研究级 Research Grade	试片级 Dummy Grade
直径 Diameter		50.8 mm±0.38 mm		
厚度 Thickness		330 μm±25μm		
晶片方向 Wafer Orientation		On axis : <0001>±0.5° for 6H-N/4H-N/6H-SI Off axis : 4.0° toward < $11\bar{2}0$ >±0.5° for 4H-N		
微管密度 Micropipe Density		≤5 cm^{-2}	≤15 cm^{-2}	≤50 cm^{-2}
电阻率 Resistivity	4H-N	0.015~0.028 Ω·cm		
	6H-N	0.02~0.1 Ω·cm		
	6H-SI	>1E5 Ω·cm		(90%) >1E5 Ω·cm
主定位边方向 Primary Flat		{10-10}±5.0°		
主定位边长度 Primary Flat Length		15.88 mm±1.65 mm		
次定位边长度 Secondary Flat Length		8.0 mm±1.65 mm		
次定位边方向 Secondary Flat Orientation		Silicon face up: 90° CW. from Prime flat ±5.0°		
边缘 Edge exclusion		1 mm		
总厚度变化/弯曲度/翘曲度 TTV/Bow /Warp		≤15μm /≤25μm /≤25μm		
表面粗糙度 Roughness		Polish Ra≤1 nm		
		CMP Ra≤0.5 nm		
裂纹(强光灯观测) # Cracks by high intensity light		None	None	1 allowed, ≤1 mm
六方空洞（强光灯观测）* Hex Plates by high intensity light		Cumulative area≤1 %	Cumulative area≤2 %	Cumulative area≤5 %
多型(强光灯观测)* Polytype Areas by high intensity light		None	Cumulative area≤2 %	Cumulative area≤5%
划痕(强光灯观测)*& Scratches by high intensity light		3 scratches to 1×wafer diameter cumulative length	5 scratches to 1×wafer diameter cumulative length	8 scratches to 1×wafer diameter cumulative length
崩边# Edge chip		None	3 allowed, ≤0.5 mm each	5 allowed, ≤1 mm each
表面污染物（强光灯观测） Contamination by high intensity light		None		

Notes:

* Defects limits apply to entire wafer surface except for the edge exclusion area.

Defects shall be existed in the edge area, only defect beyond of the prescribed scope could be considered as reject cause. & the scratches should be checked on Si face only.

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天科合达 3 英寸 SiC 晶片产品标准
3 inch diameter Silicon Carbide (SiC) Substrate Specification

等级 Grade		工业级 Production	研究级 Research Grade	试片级 Dummy Grade
直径 Diameter		76.2 mm±0.38 mm		
厚度 Thickness		350 µm±25µm		
晶片方向 Wafer Orientation		On axis : <0001>±0.5° for 4H-N/6H-SI Off axis : 4.0° toward <$11\bar{2}0$>±0.5° for 4H-N		
微管密度 Micropipe Density		≤5 cm^{-2}	≤15 cm^{-2}	≤50 cm^{-2}
电阻率 Resistivity	4H-N	0.015~0.028 Ω·cm		
	6H-SI	>1E5 Ω·cm		(90%) >1E5 Ω·cm
主定位边方向 Primary Flat		{10-10}±5.0°		
主定位边长度 Primary Flat Length		22.22 mm±3.17 mm		
次定位边长度 Secondary Flat Length		11.18 mm±1.52 mm		
次定位边方向 Secondary Flat Orientation		Silicon face up : 90° CW. from Prime flat ±5.0°		
边缘 Edge exclusion		2 mm		
总厚度变化/弯曲度/翘曲度 TTV/Bow /Warp		≤15µm /≤25µm /≤35µm		
表面粗糙度 Roughness		Polish Ra≤1 nm		
		CMP Ra≤0.5 nm		
裂纹(强光灯观测) # Cracks by high intensity light		None	1 allowed, ≤1 mm	1 allowed, ≤2 mm
六方空洞（强光灯观测）* Hex Plates by high intensity light		Cumulative area ≤1%	Cumulative area ≤2%	Cumulative area ≤5%
多型(强光灯观测)* Polytype Areas by high intensity light		None	Cumulative area≤2 %	Cumulative area≤5%
划痕(强光灯观测)*& Scratches by high intensity light		3 scratches to 1×wafer diameter cumulative length	5 scratches to 1×wafer diameter cumulative length	8 scratches to 2×wafer diameter cumulative length
崩边# Edge chip		None	3 allowed, ≤0.5 mm each	5 allowed, ≤1 mm each
表面污染物（强光灯观测） Contamination by high intensity light		None		

Notes:
* Defects limits apply to entire wafer surface except for the edge exclusion area.
# Defects shall be existed in the edge area, only defect beyond of the prescribed scope could be considered as reject cause.
& the scratches should be checked on Si face only.

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天科合达 4 英寸 SiC 晶片产品标准

4 inch diameter Silicon Carbide (SiC) Substrate Specification

等级 Grade	Z 级 Zero MPD	工业级 Production	研究级 Research Grade	试片级 Dummy Grade
直径 Diameter	100.0 mm±0.5 mm			
厚度 Thickness	350 μm±25μm			
晶片方向 Wafer Orientation	Off axis : 4.0° toward $\langle 11\bar{2}0 \rangle$ ±0.5° for 4H-N On axis : <0001>±0.5° for 6H-SI			
微管密度 Micropipe Density	≤1 cm^{-2}	≤5 cm^{-2}	≤15 cm^{-2}	≤50 cm^{-2}
电阻率 Resistivity 4H-N	0.015~0.028 Ω·cm			
电阻率 Resistivity 6H-SI	≥1E5 Ω·cm			(90%)≥1E5 Ω·cm
主定位边方向 Primary Flat	{10-10}±5.0°			
主定位边长度 Primary Flat Length	32.5 mm±2.0 mm			
次定位边长度 Secondary Flat Length	18.0mm±2.0 mm			
次定位边方向 Secondary Flat Orientation	Silicon face up: 90° CW. from Prime flat ±5.0°			
边缘去除 Edge exclusion	3 mm			
总厚度变化/弯曲度/翘曲度 TTV/Bow /Warp	≤15μm /≤25μm /≤40μm			
表面粗糙度 Roughness	Polish Ra≤1 nm CMP Ra≤0.5 nm			
裂纹(强光灯观测) # Cracks by high intensity light	None		1 allowed, ≤2 mm	Cumulative length≤10mm, single length≤2mm
六方空洞（强光灯观测）* Hex Plates by high intensity light	Cumulative area ≤1%		Cumulative area ≤2%	Cumulative area ≤5%
多型(强光灯观测)* Polytype Areas by high intensity light	None		Cumulative area ≤2%	Cumulative area ≤5%
划痕(强光灯观测)*& Scratches by high intensity light	3 scratches to 1×wafer diameter cumulative length		5 scratches to 1×wafer diameter cumulative length	5 scratches to 1×wafer diameter cumulative length
崩边# Edge chip	None		3 allowed, ≤0.5 mm each	5 allowed, ≤1 mm each
表面污染物（强光灯观测） Contamination by high intensity light	None			

Notes:

* Defects limits apply to entire wafer surface except for the edge exclusion area.

Defects shall be existed in the edge area, only defect beyond of the prescribed scope could be considered as reject cause.

& the scratches should be checked on Si face only.

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天科合达 6 英寸 4H-N SiC 晶片产品标准

6 inch diameter, 4H-N Silicon Carbide (SiC) Substrate Specification

等级 Grade	Z 级 Zero MPD	工业级 Production Grade	研究级 Research Grade	试片级 Dummy Grade
直径 Diameter	150.0 mm±0.25 mm			
厚度 Thickness^Δ	500 μm±25μm			
晶片方向 Wafer Orientation	Off axis : 4.0° toward $\langle 11\bar{2}0 \rangle$ ±0.5° for 4H-N			
主定位边方向 Primary Flat	{10-10}±5.0°			
主定位边长度 Primary Flat Length	47.5 mm±2.5 mm			
边缘 Edge exclusion	3 mm			
总厚度变化/弯曲度/翘曲度 TTV/Bow /Warp	≤15μm /≤40μm /≤60μm			
微管密度 Micropipe Density	≤1 cm^{-2}	≤5 cm^{-2}	≤15 cm^{-2}	≤50 cm^{-2}
电阻率 Resistivity	0.015~0.028 Ω·cm			
表面粗糙度 Roughness	Polish Ra≤1 nm CMP Ra≤0.5 nm			
裂纹(强光灯观测) # Cracks by high intensity light	None		1 allowed, ≤2 mm	Cumulative length≤10mm, single length≤2mm
六方空洞（强光灯观测）* Hex Plates by high intensity light	Cumulative area ≤1%		Cumulative area ≤2%	Cumulative area ≤5%
多型(强光灯观测)* Polytype Areas by high intensity light	None		Cumulative area≤2%	Cumulative area≤5%
划痕(强光灯观测)*& Scratches by high intensity light	3 scratches to 1×wafer diameter cumulative length		5 scratches to 1×wafer diameter cumulative length	5 scratches to 1×wafer diameter cumulative length
崩边# Edge chip	None		3 allowed, ≤0.5 mm each	5 allowed, ≤1 mm each
表面污染物（强光灯观测） Contamination by high intensity light	None			

Notes:

Δ Thickness of 350μm±25μm is available upon request.

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Defects shall be existed in the edge area, only defect beyond of the prescribed scope could be considered as reject cause.

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