

II-VI ADVANCED MATERIALS

SiC SUBSTRATES



HE8087-01-EN

SILICON CARBIDE (SiC) SUBSTRATES

The unique electronic and thermal properties of silicon carbide (SiC) make it ideally suited for advanced high power and high frequency semiconductor devices that operate well beyond the capabilities of either silicon or gallium arsenide devices. The key advantages of SiC-based technology include reduced switching losses, higher power density, better heat dissipation and increased bandwidth capability. At the system level, this results in highly compact solutions with vastly improved energy efficiency at reduced cost. The rapidly growing list of current and projected commercial applications utilizing SiC technologies include switching power supplies, inverters for green (solar and windmill) energy generation, industrial motor drives, HEV and EV vehicles, smart grid power switching and wireless communication base stations.

Growth Method	Physical Vapor Transport
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Physical Characteristics

Structure	Hexagonal, Single Crystal
Diameter	Up to 150mm, 200mm under development
Thickness	350 μ m (n-type, 3" Si), 500 μ m (Si)
Grades	Prime, Development, Mechanical

Thermal Properties

Thermal Conductivity	370 (W/mK) at Room Temperature
Thermal Expansion Coefficient	4.5 ($10^{-6}K^{-1}$)
Specific Heat (25 $^{\circ}C$)	0.71 ($J g^{-1} K^{-1}$)

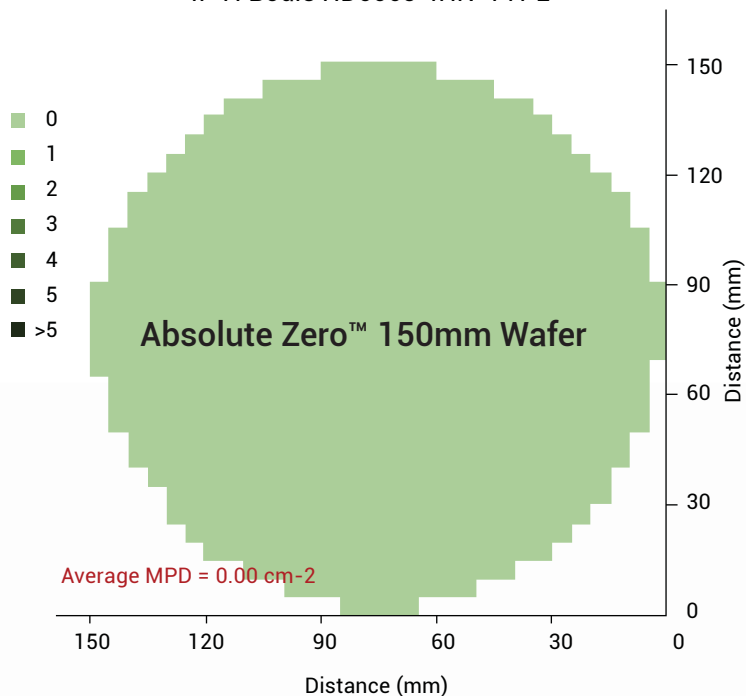
Additional Key Properties of II-VI Advanced Materials SiC Substrates (typical values*)

Parameter	N-type	Semi-insulating
Polytype	4H	4H, 6H
Dopant	Nitrogen	Vanadium
Resistivity	~ 0.02 Ohm-cm	$> 1 \cdot 10^{11}$ Ohm-cm
Orientation	4 $^{\circ}$ off-axis	On-axis
FWHM	< 20 arc-sec	< 25 arc-sec
Roughness, Ra**	< 5 Å	< 5 Å
Dislocation density	$\sim 5 \cdot 10^3$ cm $^{-2}$	$< 1 \cdot 10^4$ cm $^{-2}$
Micropipe density	< 0.1 cm $^{-2}$	< 0.1 cm $^{-2}$

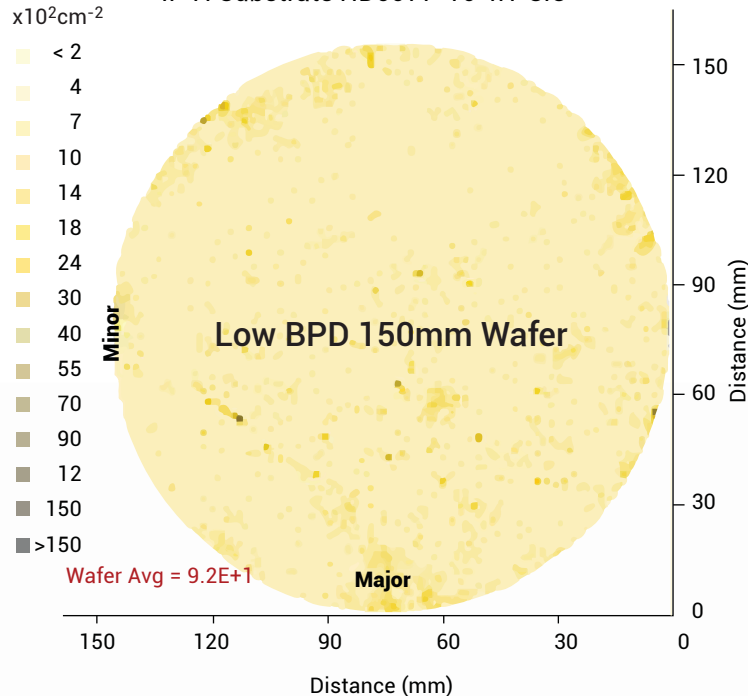
* Typical Production Values - Contact Us for Standard Specifications or Custom Requests

** Measured by White Light Interferometry (250 μ m x 350 μ m)

Micropipe Density Distribution Map
II-VI Boule HD0065 4HN-TYPE

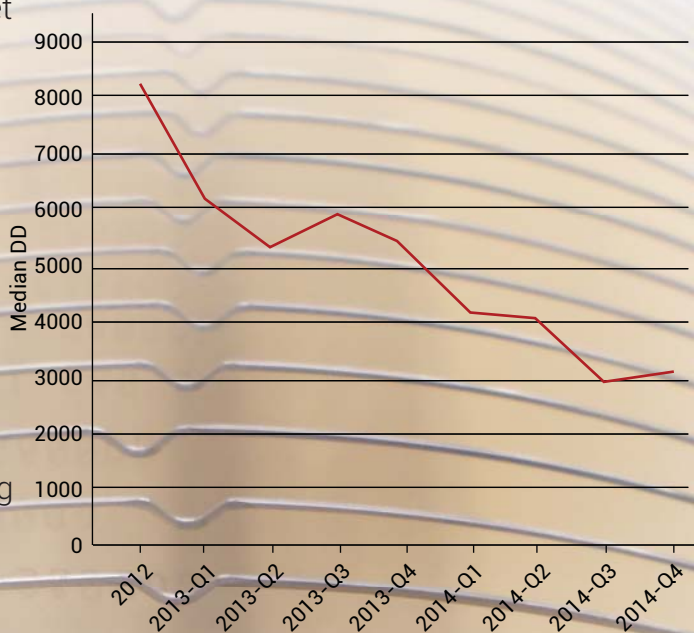


Basal Plane Dislocation Density Distribution Map
II-VI Substrate HD0077-16 4H-SiC



II-VI Advanced Materials contributes to the SiC success story by developing and manufacturing market leading quality SiC substrates. We have over 15 years of SiC production experience and a corporate background in high volume manufacturing excellence. Our large and continuously expanding IP portfolio ensures that our technology and manufacturing practices remain protected and state-of-the-art. Our relentless focus on continuously improving the material quality and increasing the substrate diameter directly benefits our customers and partners, improving their yields, reducing their costs and enabling them to manufacture new generations of devices capable of even higher performance.

Median Total Dislocation Density





WORLDWIDE LOCATIONS



About II-VI Incorporated

II-VI Incorporated, a global leader in engineered materials and opto-electronic components, is a vertically-integrated manufacturing company that creates and markets products for diversified markets including industrial manufacturing, optical communications, military and aerospace, high-power electronics, semiconductor laser and thermoelectronics applications. Headquartered in Saxonburg, Pennsylvania, with manufacturing, sales and distribution facilities worldwide, the Company produces numerous crystalline compounds including zinc selenide for infrared laser optics, silicon carbide for high-power electronics and microwave applications, and bismuth telluride for thermoelectric coolers.

About II-VI Advanced Materials

We are a leading worldwide supplier of high quality single crystal SiC (silicon carbide) substrates and CVD-grown polycrystalline diamond materials. We have state-of-the-art product development and manufacturing facilities at three locations within the United States - Pine Brook (NJ), Saxonburg (PA) and Starkville (MS). Our continually evolving technology and IP portfolio are made possible by a comprehensive understanding of crystal growth and materials processing acquired over decades of sustained R&D and manufacturing. We are committed to excellence in all that we do and consider customers to be our partners with total satisfaction as our primary goal. This is achieved through innovation, teamwork and a dedication to quality in the development of leading-edge, highly specialized products and solutions focused on customer growth and success. We utilize our II-VI global network of technical and sales offices to facilitate timely communication, service and feedback. Our products are key components "Enabling Tomorrow's Technology" across a wide variety of fast growing markets including mobile communications, RF and high-power electronics and semiconductor equipment manufacturing.

Worldwide Technical and Sales Contacts:

II-VI Advanced Materials

Tel: +1-973-227-1551

Email: advanced.materials@ii-vi.com

II-VI Deutschland GmbH

Tel: +49-6150-5439-226

Email: info@ii-vi.de

II-VI Beijing

Tel: +8610-6439-8226

Email: xiquan.wu@ii-vi.com

II-VI Japan

Tel: +81-43-297-2693

Email: advancedmaterials.info.jp@ii-vi.com