Optics

SINGLE CRYSTAL DIAMOND

ELECTRONIC GRADE

Electronic-grade single crystal diamond (SCD-E) is Coherent's highest-purity single-crystal diamond offering. With an ultra-wide bandgap, exceptional electrical performance, unmatched thermal conductivity, and extreme radiation hardness, this material sets the benchmark for next-generation electronics, detectors, and quantum technologies.

FEATURES

- Ultra-high purity
- Ultra-wide bandgap
- Exceptional carrier mobility and lifetime
- Extreme radiation hardness
- Unmatched thermal conductivity

APPLICATIONS

- Subatomic Particle Detectors
- Quantum applications
- Next-generation semiconductors

COHERENT

Grown via chemical vapor deposition (CVD), Electronic-grade single crystal diamond (SCD-E) is guaranteed to contain <10 ppb total impurities, including nitrogen and boron. This exceptional purity enables full utilization of diamond's intrinsic properties, such as extremely high carrier mobility and long carrier lifetimes, as well as its ultra-wide bandgap of 5.47 eV.

In addition to these attributes, the combination of extremely high breakdown voltage and unmatched radiation hardness makes SCD-E an ideal material for subatomic particle detection. Owing to its wide bandgap and virtually zero intrinsic carrier concentration at room temperature, diamond detectors require fewer supporting electronics and are significantly less susceptible to radiation-induced degradation over time compared to conventional detector materials. The exceptionally high thermal conductivity of pure diamond further enables rapid dissipation of heat generated during particle bombardment, allowing faster experimentation and reduced cooling requirements relative to competing materials.

SCD-E is also an excellent platform for research into next-generation power semiconductor devices. With no detectable impurities in the as-grown material, both the surface and bulk are immediately suitable for device fabrication and study—whether for field-effect transistors requiring an ultra-clean surface or vertical diodes that depend on a pristine bulk. The high purity and crystallinity also make SCD-E an outstanding candidate for ion implantation experiments. Diamond's superior thermal conductivity allows waste heat to be dissipated more efficiently than in any other bulk material, further enhancing device performance and reliability.

SCD- E also supports epitaxial growth of quantum thin films by providing a low-impurity, low-stress single crystal substrate. These properties enable reliable thin-film growth for research and development applications requiring precise material control.

Single Crystal Diamond - Electronic Grade (SCD-E)	
Growth Method	Plasma Enhanced Chemical Vapor Deposition
Physical Characteristics	
Structure	Single Crystal
Crystalline Orientation	{1 0 0} major faces
Thickness	0.25-0.75 mm
Surface Roughness - Sa	<0.5 nm
Material Properties	
Thermal Conductivity	>2000 W/mK
Thermal Expansion Coefficient	1 (10^{-6} K^{-1})
Specific Heat (25 °C)	0.536 J/g-K
Electronic Properties (Electronic Grade)	
Bandgap	5.47 eV
Breakdown voltage	1 to 2 (MV/cm)
Electron Mobility	1000-1700 (cm^2/V-s)
Hole Mobility	1200-2000 (cm^2/V-s)
Carrier Lifetime	~2000 ns
Charge Collection Dist.	>475 µm (typical, @ 0.5 V/µm applied field for 500 µm thick plate)
Charge collection efficiency	>95% for 500 µm plate, typical
[N_s^0]	<5 ppb, typical 0.1-1 ppb
[NV]	<0.03 ppb
[B]	<1 ppb

Coherent offers multiple grades of CVD diamond tailored to specific optical, thermal, electronic, quantum, and custom requirements. Contact us to discuss material selection for your application.

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