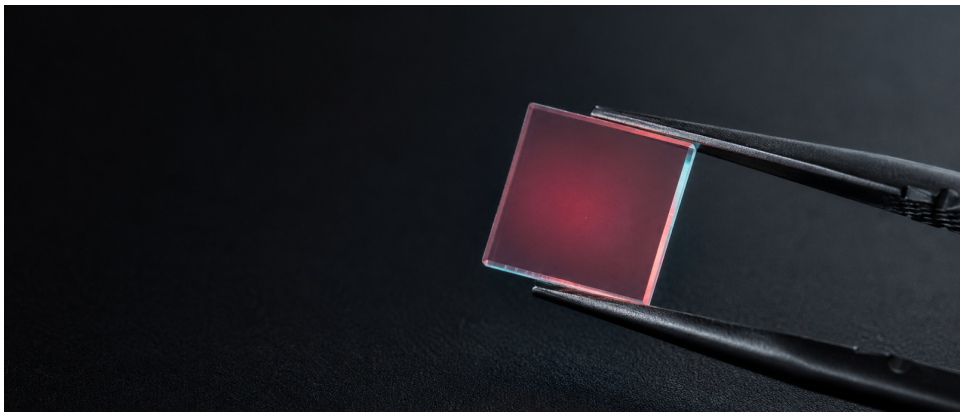
ACS MATERIAL®
Advanced Chemicals Supplier

TECHNICAL DATA SHEET

Quantum Diamonds

Nitrogen-vacancy (NV) diamond for quantum sensing, computing & metrology



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I Product Overview

The **nitrogen-vacancy (NV) center** is a unique atomic-scale defect in diamond, formed when a nitrogen atom substitutes for a carbon atom adjacent to a lattice vacancy. This defect endows the diamond with remarkable optical and electronic properties, making it a foundational element in emerging quantum technologies. NV centers exhibit stable fluorescence and exceptionally long electron-spin coherence times — and operate at room temperature, even in ambient or biological environments — enabling advanced applications in magnetic-field sensing, bioimaging, and quantum information processing.

Due to these properties, NV-diamond platforms have attracted significant interest from both academia and industry, garnering attention from leading organizations such as Lockheed Martin and Bosch. **ACS Material grows, cuts, polishes, and quantum-characterizes every diamond in house**, so the NV concentration and coherence times you order are verified before shipping.

II Product Specifications

ACS Material currently offers **five grades** of quantum diamonds, each grown and characterized for a specific class of NV experiments.

Single NV Diamond — Q-DNV-Ran(S)

Individually addressable, randomly distributed single NV centers with long T2 coherence.

FEATURES

Excellent coherence: T2 ≈ 200 µs · Controllable concentration: 1–10 per µm^2

QUANTUM PROPERTIES

[NV$^-$]	T1	T2	T2*
1 per µm^2	≈ 5 ms	≈ 200 µs	≈ 0.5–8 µs

Single NV Diamond — Q-DNV-Array(S)

Lithographically patterned NV arrays for deterministic positioning and deep, long-lived spins.

FEATURES

Depth controllable (5–100 nm) · Patterned for easy positioning of NV centers · Long coherence time, deep NV centers (T2 > 200 µs)

QUANTUM PROPERTIES

[NV$^-$]	T1	T2	T2*
0.25 per µm^2	≈ 5 ms	100–200 µs	≈ 0.3–2.2 µs

NV depth d > 50 nm

NV Ensemble Diamond — Q-DNV-2D(E)

Near-surface 2D NV ensembles with oxygen-terminated surfaces for sensitive, shallow sensing.

FEATURES

Depth controllable (5–100 nm) · Controllable concentration · Oxygen-terminated surface

QUANTUM PROPERTIES

[NV⁻]	T1	T2	T2*
10^{11}–10^{13} per cm^2	1–5 ms	10–100 µs	≈ 0.3–0.8 µs

NV depth d > 50 nm

NV Ensemble Diamond — Q-DNV-Bulk(E)

High-density bulk NV ensembles for maximum signal in magnetometry and quantum sensing.

FEATURES

Depth controllable (5–100 nm) · Controllable concentration · Oxygen-terminated surface

QUANTUM PROPERTIES

[NV⁻]	T1	T2	T2*
10–300 ppb	≈ 5 ms	50–200 µs	≈ 0.7–1 µs

Electronic-Grade Diamond — Q-DNV-ELD

Ultra-pure {100} CVD substrate with < 5 ppb nitrogen — the pristine canvas for NV creation.

Electronic-grade diamond features nitrogen impurity levels below 5 ppb and ultra-low background fluorescence, making it highly suitable for advanced quantum research.

QUANTUM PROPERTIES

Faces	Roughness	^{13}C	[N]	[B]	[NV⁻]
{100}	Ra < 3 nm	1.1%	< 5 ppb	< 1 ppb	< 0.05 ppb

ORDERING INFORMATION

SKU Chart — Standard Sizes

Type / Size	2×2×0.5 mm³	4×4×0.5 mm³
Single NV diamond — Q-DNV-Ran(S)	SKU# QDMNV001	SKU# QDMNV002
Single NV diamond — Q-DNV-Array(S)	SKU# QDMNV003	SKU# QDMNV004
NV ensemble diamond — Q-DNV-2D(E)	SKU# QDMNV005	SKU# QDMNV006
NV ensemble diamond — Q-DNV-Bulk(E)	SKU# QDMNV007	SKU# QDMNV008
Electronic-grade diamond — Q-DNV-ELD	SKU# QDMNV009	SKU# QDMNV010

Custom sizes, NV depths, and concentrations are available on request.

III Application

— Quantum communication
Single-photon NV emission for secure key distribution and quantum repeaters.

— Magnetic field sensing
Vector magnetometry with nanoscale resolution at room temperature.

— Electric field sensing
Stark-shift detection of local electric fields with high sensitivity.

— Temperature sensing
Sub-degree thermometry for biological and microelectronic systems.

— Maser
Room-temperature solid-state masers built on dense NV spin ensembles.

— Quantum gyroscope
Rotation sensing through coherent precession of NV electron spins.

IV Handling & Storage

QUALITY ASSURANCE

Every diamond is characterized in-house by confocal photoluminescence mapping and optically detected magnetic resonance (ODMR). The NV^- concentration and coherence times (T1, T2, and T2*) are measured and recorded before each unit ships.

HANDLING & STORAGE

Handle the polished faces with clean, non-metallic tweezers and store the diamonds in a dry, dust-free container. They may be cleaned with isopropanol or a standard acid protocol; avoid mechanical abrasion of the polished surfaces.