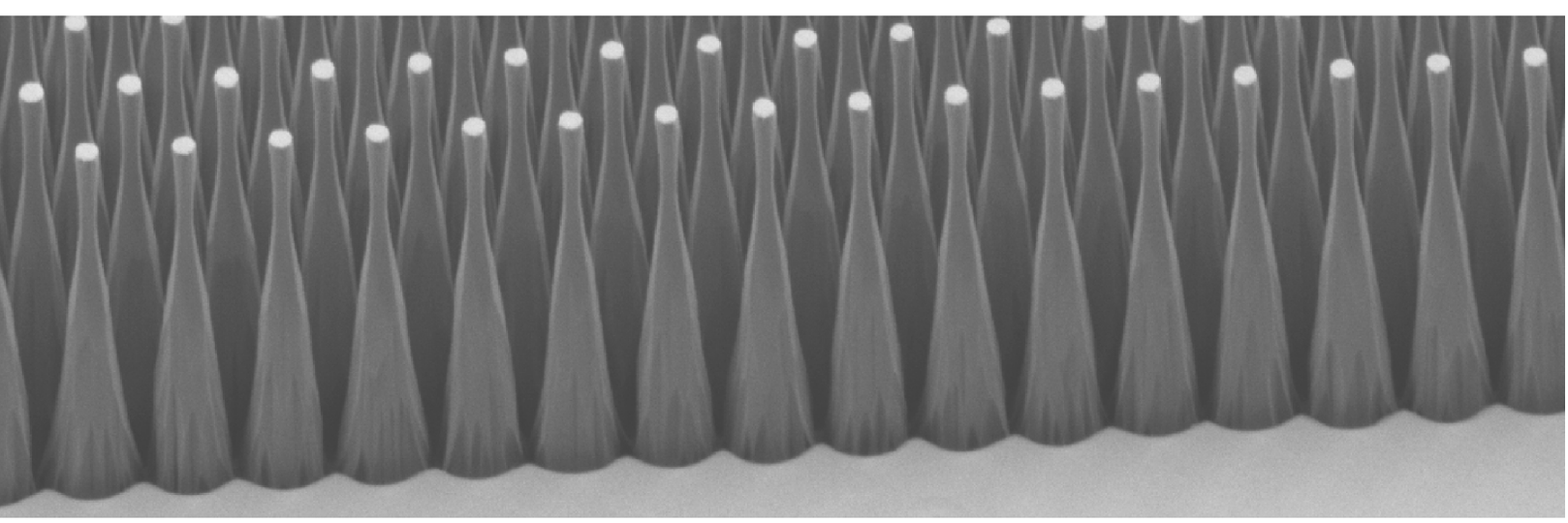
Qnami

the quantum wave

Quantum Foundry

Expert diamond engineering on demand

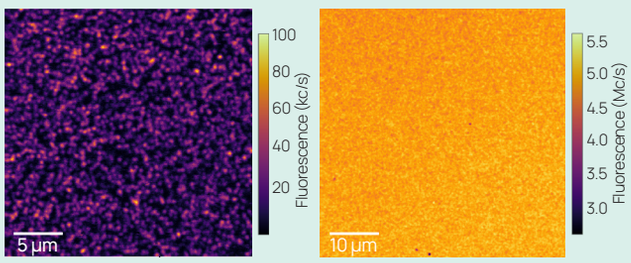


September 2022

Foundry

Foundry Services

With the Quantum Foundry, we serve as the missing link between diamond manufacturers and quantum experts.



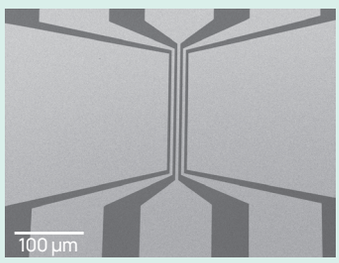
Single NV centers | Ensemble of NV centers

Diamond material

- Available as bulk (0.5 mm thick) or thin membranes (0.05 mm thick)
- Different surface orientations available ([100] ,[110] or [111])

NV centers

- Depth range: from 10 to 500 nm
- Areal density range: from 1 to 1000 NVs/µm^2 (up to 0.1 ppm)
- Other color centers available: SiV, GeV, etc.



- Flexible integration to accommodate application needs (strip lines, omega loops)
- Overlay structures and integration on customer samples
- Wire bonding to chip carriers
- High-purity deposition and growth of different materials (metals, oxides, etc.)

Creation of color centers in diamond for quantum applications

Fabrication of microwave/RF delivery structures for spin manipulation

We offer state-of-the-art diamond engineering fully tailored to our customers needs

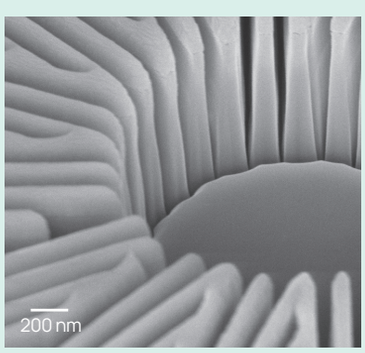
Versatile diamond micro- and nanofabrication with high-quality surface

Micro- and nano-lithography

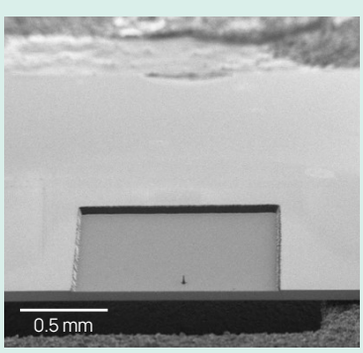
- Flexible mask design
- High-resolution e-beam and optical lithography (feature sizes down to 20 nm and 1 µm respectively)
- High-accuracy overlay (~50 nm for e-beam lithography)
- Large area patterning (up to 6” wafers)

Plasma etching

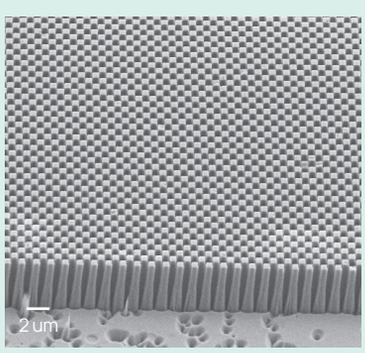
- High selectivity etching with a variety of resists/masks
- Color centers properties preserved during fabrication
- Pristine diamond surfaces using both high precision and fast etching rates



High aspect-ratio structures



Deep-etching for stress-release



Photonic structures

Use cases

Diamond membranes with arrays of nanopillars

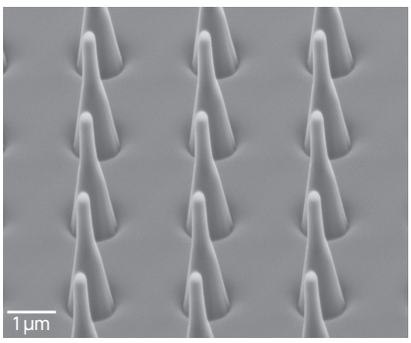
The sensing of molecules at diamond surfaces with shallow NV centers suffers severe limitations in NMR measurements due to long acquisition times and weak signals.

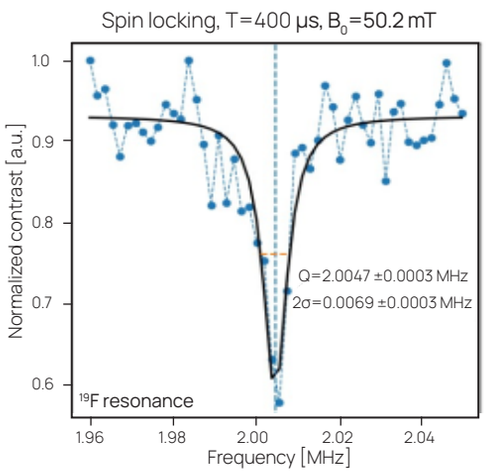
Engineering diamond surfaces while preserving NV spin properties is a major challenge. With the expertise of the Quantum Foundry, our customers have access to diamond membranes containing arrays of nano-pillars that unlock unprecedented sensitivity and signal strength for nano-NMR measurements.

Reference: Qnami Application Note - In preparation
Lead Scientist: Dr. Nabeel Aslam, Harvard University

KEY FEATURES

- Flexible pillar spacing, diameter and arrangement
- 20-50 times higher photon count rates
- 5 times higher sensitivity down to 1μT/sqrt(Hz)
- Facilitated navigation during measurements using labelled NV centers
- Large homogeneous patterned area





Diamonds with high density ensemble of shallow NV centers

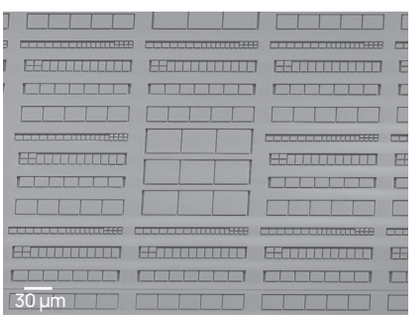
To perform wide-field imaging with dense ensembles of NV centers it is crucial to have direct contact between the sample of interest and the diamond surface.

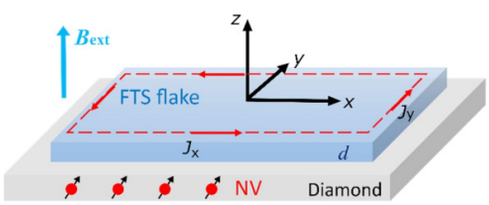
Finding the optimum geometry of diamond plates to ensure contact with specific samples requires complex diamond fabrication. The Quantum Foundry brings the know-how to engineer diamond plates containing ensembles of NVs to unlock wide-filed imaging of samples ranging from 2D materials to large-scale magnetic films.

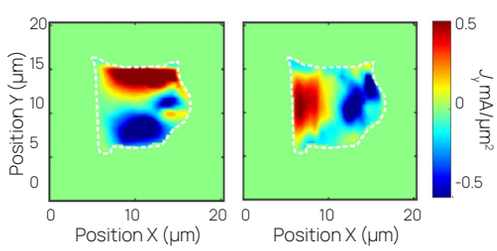
Reference: Nano Lett. 2021, 21, 7277−7283
PI: Prof. Chunhui Rita Du, University of California, San Diego

KEY FEATURES

- Flexible plates geometry and area
- NV center density up to 1000 NVs/μm^2
- Sub-micron spatial resolution







All you need for diamond engineering

With the Quantum Foundry, we serve as the missing link between diamond manufacturers and quantum experts. We engineer sensitive NV diamond quantum sensors for academic and commercial customers. We apply micro- and nano-fabrication techniques inspired by the silicon industry to produce advanced NV diamond chips with the best quantum properties.

We offer a unique technical know-how in diamond engineering for quantum implementation. With our roots in the Basel University lab, we're the first to professionalize the production of this technology for diverse applications.

CASE STUDY

Quantum sensing using NV diamonds unlocks applications ranging from fundamental color center experiments to complex high-sensitivity magnetometry measurements such as nano-NMR, ultra-sensitive analyte detection in biologic samples, neural signal imaging and much more.

Read our case study to learn more about diamond quantum sensors.

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