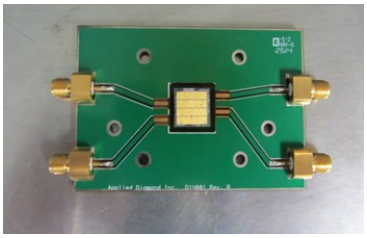
DIAMOND RADIATION DETECTORS:

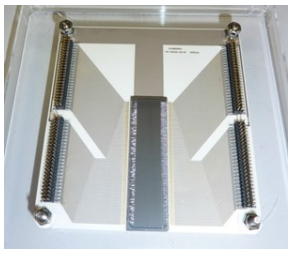
CHARGED PARTICLES, NEUTRONS, GAMMA, AND X-RAYS

NUCLEAR PHYSICS, HIGH ENERGY PHYSICS, SYNCHROTRONS, AND NUCLEAR MEDICINE

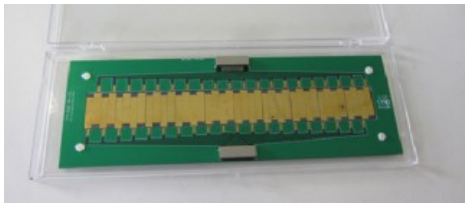
Improved Sensitivity and Timing Resolution, Greater Radiation Tolerance

The superior properties of modern ultra-high purity CVD diamond have made it a popular material for solid state radiation detectors. Diamond detectors (DD) can be used for any type of high energy radiation: charged particles (electrons, protons, muons, etc.), neutrons (fast and thermal), gamma, X-ray, and vacuum UV. Unique properties of diamond make DDs especially useful in the applications where the detector is exposed to high doses of radiation or high temperature. DDs have no cooling requirements. For example, DDs have found application in today's 3rd and 4th generation Synchrotron Light Sources, High Energy Physics (Large Hardon Collider, etc.) and Nuclear Physics (Fusion Reactors and Nuclear Reactors). Position sensitive DD meet the precise time-of-flight measurement requirements for heavy ion beams consisting of multiple ion species. DDs, having a near tissue equivalence and small sensing volume (down 0.004 mm^3), have been used for dosimetry in radiotherapy beams (electron, proton, X-ray, and gamma).





- ***Ultra-High Thermal Conductivity*** **(4 times Cu) and simultaneously** ***Ultra-High Resistivity*** **and** ***Breakdown Voltage***
- ***Large Band Gap*** **(5.45 eV) resulting in visual light blindness and low leakage current**
- ***High Electron & Hole Mobility*** **for fast signal response.** ***Picosecond Time Resolution*** **for thin TOF membrane detectors**
- ***Extreme Resistance to Radiation & Harsh Environments, Extended Life-Time***
- ***Operation at Room Temperature Without Cooling***
- ***High Temperature Operation***
- ***Large Active Area of pCVD Diamond at Low Cost***



Applied Diamond, Inc

3825 Lancaster Pike, Wilmington, DE 19805, Phone: (302) 999-1132, FAX: (303) 999-8320
www.usappliedddiamond.com, Email: services@sappliedddiamond.com

ULTRA HIGH PURITY DETECTOR-GRADE DIAMOND

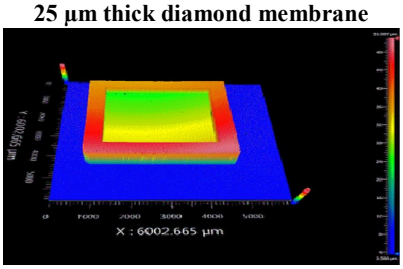
THIN PLATES, MEMBRANES, AND ASSEMBLIES

High Quality Single Crystal CVD (sCVD) Diamond

- Electronic grade, < 1 ppb nitrogen
- Sizes up to 4.5×4.5 mm^2 (active area up to 4.2×4.2 mm^2)
- Standard thickness of 50, 100, 250 and 500 µm
- Custom sizes and thicknesses are possible
- Typical metallization of 50 nm Cr and 200 nm Au
- Photolithography available for patterns
- ICP/RF dry etching available for surface topography patterns
- Operates without high voltage (typical bias ≥ 0.1 V/µm)

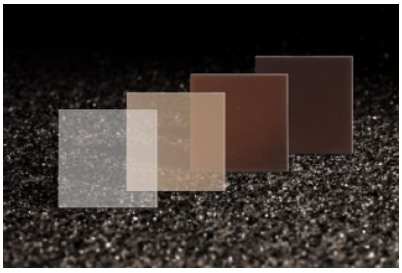
Dry ICP/RF Etching

25 µm thick diamond membrane



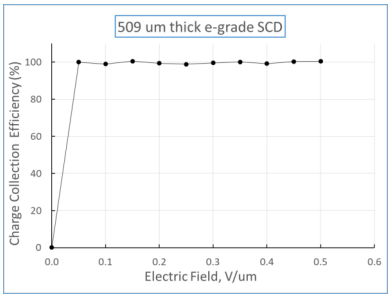
Large Size High Quality Polycrystalline CVD (pCVD) Diamond

- Electronic Grade , < 1 ppb nitrogen
- Sizes up to 30×30 mm^2 (or to 15×50 mm^2)
- Standard thickness of 50, 100, 250 and 500 µm
- Custom sizes and thicknesses are possible
- Typical metallization of 50 nm Cr /200 nm Au
- Photolithography available for metallization patterns
- ICP/RF plasma etching available for surface topography patterns

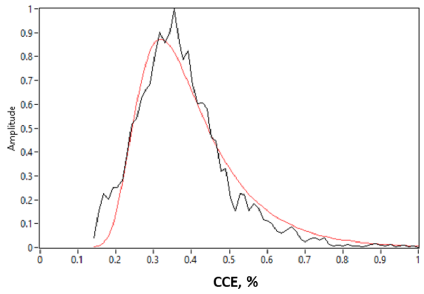


B

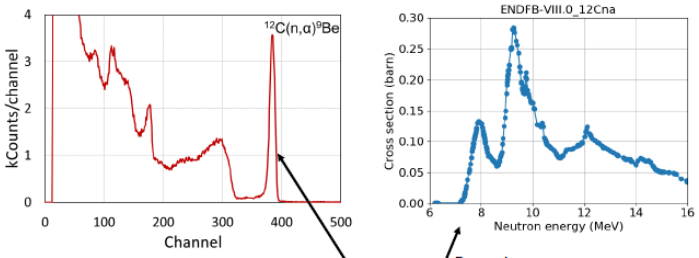
100% Charge Collection in sCVD DD



Improved Charge Collection of pCVD DD



Spectroscopy of 14 MeV neutron source

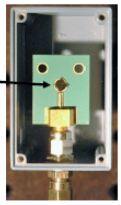


α count rate

Reaction cross section

Neutron flux $\phi_n = Y_\alpha/(\sigma N_t)$

N_t is # of C atoms in detector



4×4 mm^2 sCVD DD from Applied Diamond Inc.
Courtesy of Sandia National Lab IBL

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