microDiamond®
Type 60019

As stable as a diamond, as sensitive as a diode - the microDiamond detector is the ideal detector for a broad range of radiotherapy applications

- Perfectly suited for small and very small fields
- Excellent spatial resolution for accurate penumbra measurements
- Nearly water-equivalence
- Outstanding radiation hardness
- Negligible dose-rate and dose-per-pulse dependence
- Point dose patient QA with RUBY

The microDiamond is a synthetic diamond detector which is well characterized, unique, and versatile for high-precision dosimetry in high-energy photon, electron, proton and carbon ion beams. This all-in-one detector is the perfect detector for small and very small field dosimetry, as well as large field dosimetry. With the versatile microDiamond, you will never have to worry about choosing the right detector again.

General

Type of product	synthetic single crystal diamond detector
Application	relative dosimetry on radiotherapy beams
Reference radiation quality	^{60}Co
Design	waterproof, disk-shaped, sensitive volume perpendicular to detector axis
Direction of incidence	axial

Specification

Nominal sensitive volume	0.004 mm^3
Nominal response	1 nC/Gy
Long-term stability	≤ 0.5 % per year
Dose Stability	≤ 0.25 %/kGy at 18 MV
Temperature response	≤ 0.08 %/K
Energy response	at higher depths than d_{max}, the percentage depth dose curves match curves measured with ionization chambers within ±0.5 %
Bias voltage	0 V
Signal polarity	positive
Reference point	on detector axis, 1 mm from detector tip
Photon energy response	≤ ±2 % (140 kV ... 280 kV) ≤ ±4 % (100 kV ... ^{60}Co)
Directional response in	≤ ±1 % for tilting ≤ ±10°
Leakage[1] current	≤ ±20 fA
Cable leakage	≤ 200 pC/(Gy·cm)

Materials and measures

Entrance window	0.3 mm RW3 0.6 mm Epoxy 0.01 mm Al 99.5
Total window area density	0.1 g/cm^2
Water-equivalent window thickness	1.0 mm
Sensitive volume	radius 1.1 mm, circular thickness 1 µm
Outer dimensions	diameter 7 mm length 45.5 mm

Ranges of use

Radiation quality	100 keV ... 50 MV photons (6 ... 25) MeV electrons (70 ... 230) MeV protons (115 ... 380) MeV/u carbon ions[2]
Field size	(1 x 1) cm^2 ... (40 x 40) cm^2
Small fields[3]	down to 0.4 cm
Temperature	(10 ... 35) °C (50 ... 95) °F
Humidity	(10 ... 80) %, max 20 g/m^3

Ordering Information

TN60019 microDiamond, connecting system BNT
TW60019 microDiamond, connecting system TNC
TM60019 microDiamond, connecting system M
T40072.1.110 RUBY detector holder T60019

The microDiamond detector is realized in collaboration with Marco Marinelli and Glanluca Verona-Rinati and their team, Industrial engineering Department of Rome Tor Vergata University, Italy.

[1] I. Ciancaglionii, M. Marinelli, E. Milani, G. Prestopino, C. Verona, G. Verona-Ronati, R. Consroti, A. Petrucci and F. De Norariстefani, Dosimetric characterization of a synthetic single crystal diamond detector in clinical radiation therapy small photon beams, Med. Phys. 39 (2012), 4493

[2] C. Di Venanzio, M. Marinelli, E. Milani, G. Prestopino, C-Verona, G. Verona-Rinati, M. D. Falco, P. Bagalà, R- Santoni and M. Pimpinella, Characterization of a synthetic single crystal diamond Schottky diode for radiotherapy electron beam dosimetry, Med. Phys. 40 (2013), 021712

[1]At the high end of the temperature range, higher leakage currents may occur.

[2]In rare cases, an individual mircoDiamond can exhibit an LET dependence in proton or hadron radiation. If you suspect that this might be the case for your microDiamond, please contact PTW technical service.

[3]This detector is well suited for measurements in small and very small fields. Please note that for high accuray measurements any detector may need correction factors in small fields. The small field size limit is provided as equivalent square field size following the methodology of IAEA TRS-483:2017. In accordance with TRS-483, the smallest field size considered is 0.4 cm.