Progress in Diamond Detector Fabrication at Micron Semiconductor

Colin WILBURN, Gwenaelle LEFEUVRE

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Characterisation
surface quality
Characterisation surface quality
Characterisation
surface quality
Characterisation of surface quality
Characterisation
crystal quality
Characterisation

crystal quality

**Optical**
Magnification 50x of the area analysed

**Raman**
peak intensity map
(bright = high intensity)

**Raman**
Peak shift map
(bright = 1332 cm⁻¹)
Characterisation
surface preparation
Contact Deposition & Packaging
Testing: single crystal
Testing: single crystal

$^{241}\text{Am}$ Resolution Plot

$^{241}\text{Am}$ peak
5.486 MeV

0.8% FWHM
Testing: single crystal

DM2, bias = 300V

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
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<tbody>
<tr>
<td>A</td>
<td>76620 ± 400</td>
</tr>
<tr>
<td>B</td>
<td>1351 ± 1</td>
</tr>
<tr>
<td>C</td>
<td>171 ± 1</td>
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\[ \text{S(MIP) / N} = 27 \]
Micron’s plans

Partnerships with several institutions to develop these applications:

- **Brunel Uni. / Schlumberger**: Nuclear Power Initiative from UK govt, bore hole drilling (>125⁰C), up to 450⁰C in reactors
- **BAe Systems**: submarine solutions for neutron detection in high gamma background to replace He₃
- **ESRF / Diamond**: synchrotons
- **Medical**: radiation therapy
- **JPL / UCLA**: space
- **KEK/CERN/GSI**: physics
- **Dosimetry**: build on strong position with Si now K-level qualified
Micron’s plans

Long-term: Diamond imagers

• Similar to current MEDIPix / TIMEpix provided to CLIC, Diamond Lab., CERN/LHCb, Prague, new higher data rate TDCpix (CERN/Leicester).
• Typical ASIC size 15 x 15 mm, 256 x 256 format, 55 x 55 um
• Pixel bumping in cooperation with RAL/IZM/VTT but in-house facility planned where stud bumping already established
Micron’s plans

Long-term: Diamond imagers

- The current size 4.5 x 4.5mm of a single crystal is a stranglehold limiting progress
- The current price tag is also a limiting factor! Advances in delta doping may allow matching SC diamond on iridium, HPHT or PC diamond for a reasonable price
Thank you for your attention!