Contribution ID: **451** Type: **Poster Presentation**

Ultra smooth surface of diamonds, towards Å scale roughness for the (111) orientation

Tuesday, 30 June 2015 16:10 (1h 50m)

Abstract content
   (Max 300 words)
Formatting &
Special chars

Synthetic diamond of exceptional quality is required for many high technology applications. We mention two examples: δ-doped diamond as an electrical switch in FETs, expected to operate at high power and high frequencies; and 111-oriented diamond plates that are needed at synchrotrons such as the ESRF to serve as beam splitter monochromators working in reflection geometry (Bragg case). The surface is of special interest. It should be smooth, flat and defect free. For the diffraction application, the requirements is in addition a low miscut for the 111 surface,. In this paper, we present a summary of the different polishing techniques as well as their advantages and limits:
- Mechanical polishing with nano diamond powder.
- Oxygen electron cyclotron resonance etching, oxygen radio frequency etching or microwave etching in a O₂+SF₆+Ar gas mixture.
- Oxygen implantation, followed by annealing in vacuum at 950 ℃. ‘‘Lift-off’’ resulted from either a hydrogen plasma or an acid etch, and the final anneal in air at 500 ℃ provided an additional soft isotropic etch.
- Hot metalling: the diamond is moved with low speeds over a surface of pure Fe at 1000oC in vacuum for at least 3 hours
- Mechanical diamond-grit-less sciafe polishing at high speeds, high temperatures and high loads,
The best results include a surface with a roughness less than 2Å (rms) level over 10x10μm2 areas as measured by AFM and optical profiling, for the (111) surface orientation. The polished diamonds were then carefully quality checked by X-ray diffraction synchrotron topography at beamline BM05, at the ESRF, France, in order to visualize defects in the crystals caused by the surface damage from the polishing process.

Apply to be
 considered for a student
   award (Yes / No)?

No

Level for award
 (Hons, MSc,
   PhD, N/A)?

PhD

Main supervisor (name and email)
and his / her institution

SH Connell (UJ)

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

Yes

Please indicate whether
this abstract may be
published online
(Yes / No)

Yes

Primary author: Prof. CONNELL, Simon (University of Johannesburg)

Co-authors: Dr FERNANDEZ, B (Institut Neel, CNRS, Grenoble, France); Dr HÄRTWIG, Jürgen (European synchrotron Radiation Facility (ESRF)); Dr TRAN THI, Thu Nhi (University of Johannesburg); Mr MASHEGO, Tshepo (iThemba LABS)

Presenter: Prof. CONNELL, Simon (University of Johannesburg)

Session Classification: Poster1

Track Classification: Track A - Division for Physics of Condensed Matter and Materials