Structural and Spectroscopic Imaging with Advanced Electron Microscopies.

Supervisors: Dr Richard Beanland and Prof Ana Sanchez

Group: Microscopy

Funding: Fully funded PhD studentship (48 months) for UK or EU students.

Start date: October 2019. Application deadline: Ongoing

This project makes use of state-of-the-art aberration-corrected scanning transmission electron microscopy (STEM) for structural and spectroscopic imaging of extended defects in diamond. The goal of this project is to determine the structure of the dislocations and other defects that influence the optical and electronic properties of diamond (e.g. give rise to states in the bandgap). This work will focus on both natural and lab-grown diamond, using the latest developments in imaging and spectroscopy to work on unsolved problems that affect both commercial and scientific applications of mined and man-made diamond.

The project will use electron microscopes at Warwick (including our JEOL ARM200F for atomic resolution imaging and EELS both in STEM and TEM modes), the electron Physical Science Imaging Centre (ePSIC) at Harwell (including JEOL ARM200CF optimised for atomic resolution spectroscopy and JEOL ARM300CF optimised for high resolution imaging). Analysis at Warwick will be augmented by high resolution analysis at ePSIC and the world-leading spectroscopy capabilities of the Nion UltraSTEM, at the EPSRC mid-range facility SuperSTEM, Daresbury, which pushes atomic resolution spectroscopy into regimes that were previously only accessible by optical techniques, increasing spatial resolution by a thousand times (https://doi.org/10.1103/PhysRevLett.122.016103).

The project will make use of extensive capabilities at Warwick for TEM sample preparation and spectroscopic characterisation, including single defect spectroscopy. A key part of the project will be to link the different techniques for imaging and spectroscopy on the same samples across different length scales. There will be close collaboration with research groups (including Jon Goss, Newcastle) modelling low-loss and core-excitation EEL spectra on various dislocation structures in diamond.

The start date for the project will be 1st October 2019. You should have obtained, or be about to obtain a First or Upper Second Class UK Honours degree in Physics, or a related subject, Alternatively, applicants with equivalent qualifications gained outside the UK will also be considered.

The successful applicant will join a team of over 10 academics and 20 PhD students in the departments of Physics, Chemistry, Engineering and the Warwick Manufacturing Group all researching into different aspects of Diamond Science and Technology. Warwick has excellent facilities for characterisation and processing of diamond, as well as the fabrication of micro/nano diamond devices and an exceptionally strong record of successful collaboration with industry.

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