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TEM Study of the Fabrication Processes in Diamond

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Sala Wataghin, Istituto di Fisica, via P. Giuria 1

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Abstract

The progress in fabrication of synthetic diamond results in increasing number of its potential applications. The desired engineering devices can be created in diamond by combination of MeV ion implantation and low keV focused ion beam milling (FIB). High fluence MeV ion implantation creates the buried damage layers and eventually the graphite-like layers upon annealing. The etchable graphitic layers can be removed to form free standing membranes into which the desired structures can be sculpted using FIB milling.

Transmission electron microscopy (TEM) would be powerful tool to solve arising research questions in these fabrication processes in diamond. However, due to its extreme properties, it is very hard to prepare TEM sample from diamond using traditional methods of preparation and not many TEM studies in diamond have been reported so far. At the same time diamond can be easy micro-machined in the shape of the TEM sample using FIB technique.

Utilizing FIB technique for the sample preparation, the processes of the ion beam induced amorphisation and graphitization in diamond which used for the device fabrication were studied in details using cross-sectional conventional and analytical TEM. Also, the process of the FIB interaction with diamond will be presented.

The Author

Sergey Rubanov received his Master Science in Physics at the Novosibirsk State University (Russia) and subsequently his PhD in Materials Science at the University of New South Wales (Australia). Between 2003 and 2006 he was part of the Centre for Quantum Computer Technology team at the School of Physics, University of Melbourne. Sergey has been research fellow in the Bio21 Electron Microscope Unit since 2006. He supervises the operation of the Nova dual-beam, focused ion beam system and the Tecnai TF20 transmission electron microscope.

His research interests include: ion implantation, film growth and characterization, nanofabrication with focused ion beam, secondary electron emission, and transmission electron microscopy.