

Focused and collimated ion beams for the deep ion beam lithography of diamond

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In the lecture a case study will be presented on direct MeV ion beam writing techniques for the microfabrication of artificial diamond. Diamond is a wide-bandgap material with a remarkable set of extreme physical properties which make it extremely appealing for a broad range of technological applications, ranging from biosensing to quantum photonics. The same physical properties (hardness, chemical inertness, etc.) that make diamond a promising advanced material, also determine a significant challenge for its micro-fabrication. Focused and collimated MeV ion microbeams represent a powerful tool to meet this challenge, since they offer the possibility of directly tailoring the structural, optical and electrical properties of the material via direct ion beam writing. In particular by tuning the implantation parameters (ion species and energy, fluence, etc.) it is possible to control the formation of specific defects in the crystal structure, over a range spanning from the formation of specific point defects to the induction of a full phase transition to graphitic carbon. In the the lecture the most recent progresses in ion-beam microfabrication of diamond will be summarized and critically assessed.