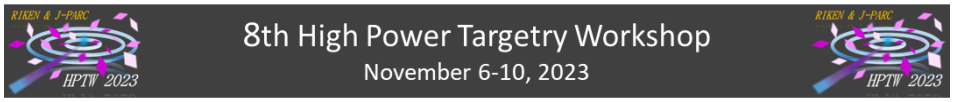

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Irradiation damage of diamond by ion implantation

Monday, 6 November 2023 14:15 (30 minutes)

Diamond is expected to be applied to next-generation power electronics and quantum sensor, due to its excellent and unique physical properties. As in the field of semiconductor device industry with other materials, ion implantation technology is indispensable for realizing diamond devices because of its design flexibility, where depth and concentration can be controlled by ion energy and dose, respectively. A lot of research has been carried out since the 1960s. However, irradiation damage is simultaneously introduced, that degrades electronic properties and device performances. In addition, the accumulation of defects induces graphitization and prevents from returning to crystalline diamond.
As for the doping technique, boron, the most promising p-type dopant, was successfully ion-implanted to show p-type characteristics from an early stage, although sufficient electronic properties for device applications have not yet been achieved. On the other hand, clear n-type properties have not been shown by ion implantation. A key issue is how to eliminate the influences of irradiation damage.
On the contrary, there are fields in which point defects by ion implantation can be effectively utilized. For example, a great deal of attention is recently paid on research on applications to quantum sensing devices using magnetic resonance related to the vacancy complexes with additive elements such as nitrogen (N-V center) in diamond. Here, it is necessary to control the position so that a vacancy should be located next to an ion-implanted additive element.
This presentation will introduce the research on controlling defects as irradiation damage caused by ion implantation into diamond semiconductor for the purpose of applying diamond to various devices.
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Themes for the contribution

2 Radiation damage in target material and related simulations:

Primary author: Dr OGURA, Masahiko (AIST/Japan)

Presenter: Dr OGURA, Masahiko (AIST/Japan)

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