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Boron detection in diamond by the nuclear reaction 11B(p ,α)8Be

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The diamond is an especially attractive material because of its gemological value as well as its unique mechanical, chemical and physical properties. One of these properties is that diamond is an electrically semiconducting material at practically any desired value when doped with boron (p-type). This property makes it possible to use diamond for multiple industrial and technological applications.

Although boron doped p-type diamond exists in nature, the boron can be incorporated into pure diamond by different techniques such as implantation. Generally, the typical energies used to dope diamond by ionic implantation are about 200 keV though some implantations have also been achieved with high energies. The CMAM internal microbeam line has demonstrated to be a powerful setup to implant boron with high energies. An 8 MeV boron beam with a size of about 5 x 5 μm2 and a beam current higher than 500 pA has been implanted controlling the beam position and fluence at all irradiated points. The subsequent mapping of the implanted boron in diamond has been achieved using the strong and broad nuclear reaction 11B(p ,α)8Be at Ep = 660 keV. This reaction has a high Q-value (8.59 MeV for α0 and 5.68 MeV for α1) and thus is almost interference free. The sensitivity of the technique and the best experimental conditions are studied in this work.

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