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Plasma Ion Implantation for Photonic and Electronic Device Applications

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Plasma Ion Implantation (PII) is a versatile ion implantation technique which allows very high fluence ion implantation into a range of targets. The technique is conformal to the surface of the implanted object, which makes it suitable for a wide range of applications. The ease with which high ion fluences can be delivered means that the technique can be used to change the stoichiometry (e.g. elemental composition) as well as the atomic-level structure of the target material in the implanted region. When combined with masking techniques and post-implant thermal processing, PII offers a powerful way to make new materials in-situ (e.g. within an existing solid-state matrix). The Plasma Physics Lab (PPL) at the University of Saskatchewan is home to a custom PII system with ion implantation energies ranging from 0-20 keV. This system is capable of a delivering very high ion doses in short times (e.g. high ion fluences) and has been employed in a range of applications, primarily oriented toward applications in photonics, to modify the properties of a variety of semiconductor materials. It has been used to fabricate luminescent silicon Schottky diodes based on silicon nanocrystals as well as SiC nanocrystallites. A more recent, low energy application of the system is N-doping of graphene, a technologically important new material for future electronic and photonic applications.

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