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Ion Irradiation of SiC and GaN: One Technique for Different Purposes

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Ion implantation is being routinely used to create doped regions that act as active channel layers or contacts in semiconducting materials. Here, the emphasis is placed on less conventional applications of energetic ion beams. First, a brief survey of the phenomena that may accompany the passage of an ion through matter will be outlined. This will include the emission of electrons, photons and single or cluster atoms leaving the solid surface as well as the process of damaging the crystal, generation of collisional cascades, ion mixing etc. In particular, diffusion and segregation behavior of hydrogen and oxygen in silicon carbide subjected to H implantation and subsequent annealing were studied with a number of analytical techniques [1]. At sufficiently high doses, a well-defined buried planar zone forms in SiC at the maximum of deposited energy, comprising numerous microvoids and platelets that are trapping sites for hydrogen atoms. For gallium nitride, the accelerator beam was used to either n-type doping of a sub-surface layer or to completely isolate a small volume of the semiconductor. Lateral isolation was accomplished by a low-dose implantation of Al+ while the vertical electrical separation – through formation of a buried, highly damaged layer created by proton irradiation [2]. Implant isolation retains the planarity of the surface for subsequent resist application and metal step coverage giving a significant advantage over chemical mesa etching.

References

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