Introduction

Silicon carbide (4H-SiC) is a wide-bandgap semiconductor with attractive applications in the field of high power devices. Epitaxial growth of SiC is crucial to produce structures with controlled thickness and doping concentration. Ion implantation, on the other hand, is used to create spatially defined doped regions with n- and p-type characteristics in SiC. Implantation is usually followed by a post-implantation annealing step, to ensure lattice recovery and electrical activation of the donors. However, mitigating implantation and post implantation annealing-induced defects, and understanding their formation mechanisms, remain a challenge.

Characterization of ion implanted samples requires investigation of the depth distribution in the implanted samples, as well as the energetic position of defects. For this purpose, low-energy muon spin spectroscopy is used to obtain nanometer depth-resolved information, combined with Deep Level Transient Spectroscopy (DLTS), Minority Carrier Transient Spectroscopy (MCTS), and Capacitance-Voltage (C-V) measurements.

Scope of the Thesis

The aim of this bachelor/semester thesis is to investigate and characterize defects created during ion-implantation of nitrogen (N) and phosphorus (P) to obtain n-type and aluminum (Al) to obtain p-type regions with selective doping in SiC.

The scope of this thesis work is organized in the following topics:

• Survey of literature related to ion-implantation for doping of SiC and related defects (10 %).
• Device characterization using C-V and I-V measurements (20 %).
• Defect characterization and identification using DLTS/MCTS (30 %).
• Analysis of the C-V and DLTS/MCTS data (30 %).
• Documentation (10 %).

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