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Measurements of depth dependent modification of optical constants arising from H^+ implantation in n-type 4H-SiC using coherent acoustic phonons¹ ANDREY BAYDIN, HALINA KRZYZANOWSKA, Vanderbilt University, M. DHANUNJAYA, S.V.S. NAGESWARA RAO, University of Hyderabad, JIMMY L. DAVIDSON, Vanderbilt University, LEONARD C. FELDMAN, Rutgers University, NORMAN H. TOLK, Vanderbilt University — Silicon carbide (SiC) is an ideal material for new electronics, such as high power/high temperature devices, and a candidate for advanced optical applications such as room temperature spintronics and quantum computing. Both types of applications may require the control of defects created by ion bombardment. In this work, we examine depth dependent modification of optical constants of 4H-SiC due to hydrogen implantation at 180keV and low doses ranging from 10^{14} to 10^{16} cm^{-2} probed by coherent acoustic phonon (CAP) spectroscopy. For our studies, we used Si-face $10\mu\text{m}$ epilayers of n-type 4H-SiC grown by CVD on 4H-SiC substrate. A comprehensive analysis of the reference and implanted spectra shows a strong dependence of 4H-SiC complex refractive index shape versus depth on the H^+ fluence. We extract the complex refractive index as a function of depth and ion beam dose. Our results demonstrate that the implantation-modified refractive index is distributed over a greater depth range than Monte Carlo calculation predictions of the implantation induced structural damage. These studies provide insight into the application of hydrogen ion implantation to the fabrication of SiC-based photonic and optoelectronic devices.

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