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The Structural and Electrical Properties of Cadmium Implanted Silicon Diodes at Room Temperature

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Abstract : This study reports on the x-ray crystallography (XRD) structure of cadmium-implanted p-type silicon, the current-voltage (I-V) and capacitance-voltage (C-V) characteristics of unimplanted and cadmium-implanted silicon-based diodes. Cadmium was implanted at the energy of 160 KeV to the fluence of 10^{15} ion/cm^2. The results obtained indicate that the diodes were well fabricated, and the introduction of cadmium results in a change in behavior of the diodes from normal exponential to ohmic I-V behavior. The C-V measurements, on the other hand, show that the measured capacitance increased after cadmium doping due to the injected charge carriers. The doping density of the p-Si material and the device's Schottky barrier height was extracted, and the doping density of the undoped p-Si material increased after cadmium doping while the Schottky barrier height reduced. In general, the results obtained here are similar to those obtained on the diodes fabricated on radiation-hard material, indicating that cadmium is a promising metal dopant to improve the radiation hardness of silicon. Thus, this study would assist in adding possible options to improve the radiation hardness of silicon to be used in high energy physics experiments.

Keywords : cadmium, capacitance-voltage, current-voltage, high energy physics experiment, x-ray crystallography, XRD
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