Abstract

The effects of Fe-implantation on the electrical characteristics of Au/p-Si Schottky barrier diodes (SBDs) were studied using current–voltage (I–V) and capacitance–voltage (C–V) techniques. The Rutherford Backscattering Spectrometry (RBS) and Energy Dispersive Spectroscopy (EDS) results showed that Fe ions are well implanted and present in the Fe-implanted Si material. The acquired results from I–V and C–V analysis showed that the diodes were well fabricated, and Fe-implantation changed the normal diode's I–V behaviour from typical exponential to ohmic. The ohmic behaviour was described in terms of the defect levels induced by Fe in the middle of the band gap of Si. The conduction mechanism for both forward and reverse currents was presented, and the effect of Fe-implantation on the conduction mechanisms was investigated. The C–V results show that Fe generates a high density of minority carriers in p-Si, which agreed with the increase in reverse current observed in the I–V results. The diode parameters in terms of saturation current, ideality factor, Schottky barrier height, doping density, and space charge region (SCR) width were used to investigate the effect of Fe in p-Si based diode. Owing to the observed changes, which were analogous to those induced by dopants that improve the radiation hardness of silicon, it was safe to say that Fe can also assist in the quest to improve the radiation hardness of silicon using the defect-engineering method.