ABSTRACT

In this study, we investigated the effects of Zn doping on electrical properties and conduction mechanisms of n-silicon (n-Si) diodes using current-voltage (I–V) and capacitance-voltage-frequency (C–V–f) measurements. The results revealed that Zn doping alters the I–V behaviour of the diode from a typical exponential curve to an ohmic one. Notably, Zn doping increased the reverse current by a factor of 37, while reducing the forward current by a factor of 3 at 3 V. This suggested that Zn-related defects introduced more minority carriers into the Si. The introduction of minority carriers is confirmed by a change in material conductivity-type from n-to p-type. Moreover, Zn doping reduces the full depletion voltage (FDV), meaning the diode could be fully depleted with a lower voltage. This reduction in FDV was crucial for designing highly sensitive radiation detectors. The observed changes in the diode's electrical behaviour were attributed to defects introduced by Zn into Si. Zn-doped n-Si diodes exhibited characteristics akin to radiation-resistant diodes. These findings implied that Zn may be instrumental in advancing research focused on enhancing silicon properties and developing radiation-resistant detectors for high- energy physics studies.