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Lattice location of implanted 59Fe in 3C-SiC

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SiC is a wide band gap semiconductor with an increasing number of applications in high-temperature electronics. Similar to Si, transition metals (TMs) in SiC are the source of deep levels in the band gap, however, the knowledge on structural properties of TMs in SiC, such as possible lattice sites, is much less advanced. In this work we report first results on the lattice site location of implanted 59Fe (45 d) in single-crystalline cubic (3C)-SiC, evaluated by means of the emission channeling effect. Following 40 keV low-fluence (3 × 1013 cm⊠2) ion implantation, the ⊠⊠ emission patterns from 59Fe implanted samples were measured with a position-sensitive electron detector around the <100>, <111>, <110> and <211> crystallographic directions. All measurements were performed at room temperature, starting with the as-implanted state and following 10 minute isochronal annealing steps up to 900 °C in vacuum. While the data analysis is still in progress, so far clearly Fe atoms located on two different lattice sites have been identified. As-implanted, the major fraction of 59Fe (⊠24-30% before correcting for background from backscattered electrons), sits near tetrahedral interstitial sites with C atoms as nearest neighbours (TC). A smaller fraction (⊠14%) is located near substitutional Si sites (SSi). In both cases, however, the Fe atoms seem to be displaced roughly 0.1-0.3 Å from the ideal TC and SSi sites. Starting at an annealing temperature of 700℃ a decrease in the number of Fe at interstitial sites became obvious, however, this was not fully reflected in a corresponding increase in the amount of Fe on substitutional sites. The analysis of the experimental data is on-going and the use of three-site fits is likely to reveal further sites of Fe (e.g. TSi, SC) which may be occupied with minor fractions.

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