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Silver (Ag) co-implanted with helium (He) into polycrystalline SiC at 350 ℃: Structural evolution of SiC and migration behaviour of Ag after annealing

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Polycrystalline SiC samples were implanted at 350 ℃ with 360 keV Ag ions (Ag-SiC), and some of the Ag-SiC samples were co-implanted with 17 keV He ions (Ag+He-SiC). The Ag-SiC and Ag+He-SiC samples were annealed isochronally at 1000 to 1300 ℃ in steps of 100 ℃ for 5 h. Before and after annealing, samples were characterized using Raman spectroscopy, transmission electron microscopy (TEM), scanning electron microscopy (SEM), atomic force microscopy (AFM), and Rutherford Backscattering Spectrometry (RBS). Our investigation found that Ag implantation and Ag and He co-implantation resulted in defects in SiC structure without amorphization and the formation of He bubbles (manifested as blisters on the surface) in the damaged layer of co-implanted samples. Annealing caused the formation of voids (on the surface) and cavities (in the damaged layer) in the co-implanted samples due to the diffusion of He bubbles. Voids acted as diffusion pathways for Ag and assisted in significant loss, while practically no loss was observed in the Ag-SiC samples annealed under the same conditions. Limited recrystallization was observed in the co-implated samples due to large cavities in the projected range of He, which acts as entrapment for the precipitation of Ag atoms.

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