Damage recovery in Ar irradiated 4H-SiC by SHI

The atomistic features of damage recovery in 4H-SiC are studied utilizing an ultrafast thermal spike with a period of a few picoseconds created by intense ionizing energy deposited using 100 MeV Ag ions. To demonstrate swift heavy induced (SHI) recovery, sequential single ion irradiations with 300 keV Ar and 100 MeV Ag in 4H-SiC are performed in samples with varying degrees of pre-damage and Ag ion fluences (ions/cm2). The findings highlight the importance of various degrees of pre-damage i.e. initial physico-chemical conditions, and irradiation temperature in observing SHI-induced recrystallization, as determined by Rutherford Backscattering/Channeling and Raman spectroscopy. For samples with different initial disorders, the absence of significant crystalline surroundings, and the development of complex defects with homonuclear bonds are found to impede the recovery process. For samples having the same initial pre-damage, the SHI fluence is found to play a significant role in determining the extent of damage recovery. The results are interpreted within the framework of the SHI-induced inelastic thermal spike model.