F Center Formation in Sapphire Under Low Dose Low Energy Ar Irradiation  

EMMANUEL NJUMBE, DHARSHANA WIJESUNDERA, BUDDHI TILAKARATNE, WEI-KAN CHU, TcSUH Ion Beam Lab, University of Houston — Optical spectroscopy and Rutherford Backscattering Spectrometry Channeling (RBS-C) have been used to study F center dynamics in 170 keV Ar\(^+\) irradiated single crystals of sapphire (\(\alpha\)-Al\(_2\)O\(_3\)) at room temperature for implantation doses between \(10^{13}\) Ar\(^+\) cm\(^{-2}\) to \(5 \times 10^{14}\) Ar\(^+\) cm\(^{-2}\). F center density (\(N_F\)) has been found to display an initial rapid linear increase with Ar\(^+\) dose and then saturate to a maximum value of \(4.02 \times 10^{14}\) cm\(^{-3}\). Fitting experimental results with a Poisson relation suggest an estimated electron capture range of \(4.24 \times 10^{-10}\) m around an Oxygen vacancy. A possible explanation to this behaviour is presented.