

Tracks in epitaxial $\text{Si}_{1-x}\text{Ge}_x$ alloy layers: Effect of layer thickness

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Strain-relaxed epitaxial $\text{Si}_{0.5}\text{Ge}_{0.5}$ alloy layers were irradiated with 2.7-GeV ^{238}U ions in the electronic stopping regime. Using transmission electron microscopy, clear evidence is found that details of track formation such as morphology, defect structure, and number density strongly depend on the thickness of the sample. Amorphous tracks of diameter of ~ 5 nm are formed at the outer edge (15–20 nm thick) of a wedge-shaped sample. In thicker sample regions (30–40 nm and ~ 70 nm), the structure of the tracks is crystalline and the tracks contain clusters of point defects and dislocation loops. The track morphology exhibits a more or less discontinuous character.

The results are ascribed to higher thermal-spike temperatures in thin layers due to restricted energy dissipation and increased surface scattering of excited electrons.