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Engineering magnetic carbon nanotubes via swift heavy ion irradiation for spintronics and quantum technologies: XAS and RAMAN study

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Carbon nanotubes (CNTs), known for their versatility as 2D materials, are key to advancing quantum technologies such as qubit fabrication and magnetic data storage. In this study, multi-walled carbon nanotubes (MWCNTs) doped with magnetic impurities (Fe and Co) were exposed to swift heavy ion (SHI) irradiation to explore induced structural modifications. SHI beams transfer energy to the carbon matrix via electronic energy loss and thermal spikes, causing Fe and Co ions to agglomerate within interstitial regions and defect sites of the CNT matrix. Structural changes were analyzed using high-resolution X-ray diffraction (HRXRD), Raman spectroscopy, and near-edge X-ray absorption fine structure (NEXAFS). HRXRD revealed peak dissolution, reduced crystallinity, and increased lattice strain, while Raman spectra showed partial annealing of damaged CNTs with disorder parameter reduction (FeCNT: 0.65⟶0.57; CoCNT: 0.55⟶0.52). NEXAFS confirmed non-destructive processing. These findings link ion fluence with defect engineering, paving the way for magnetic CNTs in spintronics and data storage.

Footnotes

- ABC et al, sdadada , (2021).

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