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Electron Beam Stimulated Molecular Motions of C_{60}s inside Single-Walled Carbon Nanotubes KE RAN — Electron beam irradiation stimulated motions of carbon nanostructures from single C_{60} to C_{60}s chain inside single-walled carbon nanotubes (CNTs) were investigated by low voltage and high resolution TEM. Single C_{60}'s jump in a defective zigzag C_{60}s molecular chain inside host CNT was observed. A cluster of C_{60}s inside an isolated partially filled CNT can translate back and forth within the hollow space for several times. Intermediate states of these translations were recorded as well, together with pickup of additional C_{60}s when the moving cluster reached either end of the hollow space. Continuous rotation of a zigzag C_{60} molecular chain inside an overloaded CNT resulted in alternate expansion and contraction of the projected width of the host CNT in the TEM images. The maximum expansion was up to 29%. Potential calculation for the molecular motion was performed based on the van der Waals interaction among C_{60}s and CNT. Activation energies ranging from 0.3 eV to 0.7 eV were estimated. The molecular motion was attributed to momentum transfer during elastic scattering of electrons by the molecules, instead of thermal energy or thermal gradient. Our study demonstrates the potential of driving molecular motion by electron irradiation.

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