Electron-Impact Promoted Selective [2 + 2] Cycloaddition Mediated by Carbon Nanotube

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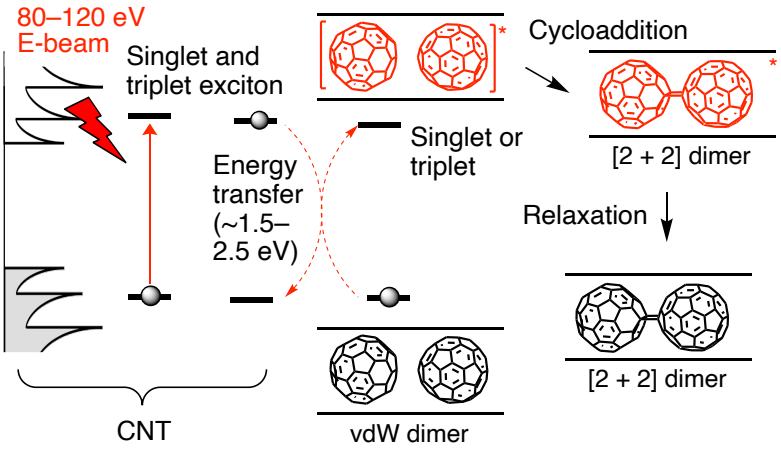
Attention toward chemical applications of transmission electron microscopy (TEM) has been increasing but such studies are often plagued by radiation damage, which occurs via ionization (radiolysis) for organic matters.[1] Although radiolysis is highly important in the field of TEM, previous studies on radiolysis have largely been descriptive and qualitative due to the lack of methods to probe molecular mechanism. Here, we adopted chemically well-defined system to study radiolysis.

We chose thermally-forbidden [2 + 2] cycloaddition of a van der Waals dimer of [60]fullerene (C_{60}) to C_{120} in a carbon nanotube (CNT) that proceeds under electron beam (e-beam) irradiation[2] and conducted variable-temperature[3] and variable-voltage (VT/VV)[4] study to investigate reaction paths and effects of e-beam. With the VT/VV study, we identified five reaction pathways that serve as mechanistic models of radiolysis damage, which demonstrate the importance of VT/VV kinetic analysis in the studies of radiation damage.



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