

^{60}Co gamma ray irradiation studies on pentacene films: Its effects on structural and electronic properties

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Abstract –Thin pentacene films were gamma ray irradiated using ^{60}Co source over 0-3KGy of radiation doses. By X-ray diffraction and Near Edge X-ray Absorption Fine Structure (NEXAFS), we found that the gamma ray irradiation creates defects which resulted in the decrease in the X-ray diffraction intensities both in the plane normal and in-plane directions. From NEXAFS, the transition from C1s to π^* orbital for samples irradiated at higher doses increases suggesting that the unoccupied π^* state enhanced; might be due to influence of radical reaction or defects created in the pentacene films. Additionally, the resistivity decreases from pristine to irradiated sample as the dose level increases that further confirms the increase in conductivity. This result is also compatible with C1s to π transition that manifests the increase in carrier concentration. Overall it suggests that pentacene is one of the radiation tolerant organic electronic materials due to its aromatic rings, whose structure remains mostly intact even after exposure to high dose irradiation. And by post irradiation annealing, we noticed the possibility of recovery of the film intensity. Thus, our findings suggest that pentacene could be exploited as a reversible radiation dosimeter in the future.