

Real-Time Observation of Temperature-Dependent Strain in Poly (3-hexylthiophene) Crystals in a Mixed Donor and Acceptor Thin Film

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We observed strain evolution of P3HT crystals in P3HT:PCBM films and the effect of Al electrode on the evolution during real time annealing process. Based on simple assumptions, both relaxed lattice parameters and thermal expansion coefficient could be quantitatively determined. P3HT:PCBM films displayed tensile strain in as-prepared samples regardless of the presence of an Al layer. In the absence of Al layer, P3HT crystals showed only strain relaxation at an annealing temperature of 180°C. Meanwhile In the presence of an Al layer, the strain was relaxed and changed to compressive strain at around 120C annealing temperature, which indicated a tightening of the thiophene ring packing. These behaviors support the improved performance of devices fabricated by post annealing process.

Keywords: organic solar cells, P3HT; PCBM, strain, thermal expansion, synchrotron x-rays