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Optical Spectroscopy during Growth of PTCDA-C₆₀ Complex Thin Films

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Abstract:

Combined Raman and photoluminescence (PL) measurements were performed in situ and online during the formation of a PTCDA-C₆₀ charge transfer (CT) complex film using organic molecular beam deposition. It is found that two different processes compete during growth, namely the formation of PTCDA-C₆₀ CT complexes and the photopolymerization between C₆₀ molecules. The CT complexes, formed instantaneously upon the co-deposition of two molecules, decompose as the C₆₀ molecules forming the CT complexes undergo the photopolymerization with excess C₆₀ molecules. At low coverage, 70% of PTCDA molecules in the film form CT complexes with C₆₀. The rate of CT complex formation decreases dramatically with the beginning of the photopolymerization after 11 min of deposition. The results prove the importance of preventing the formation of C₆₀-C₆₀ pairs in order to keep the maximum ratio of CT complexes in the film under laser irradiation.