Analysis of Photoconversion Reaction in a Pentacene Precursor Film

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Pentacene (PEN, Figure 1(a)) is used as an active layer for organic field-effect transistors (OFETs) [1]. Since this compound is essentially insoluble in most solvents, thin films are generally prepared by vacuum deposition [2]. To develop solution-processed OFETs, Yamada and co-workers synthesized 6,13-dihydro-6,13-ethanopentacene-15,16-dione (PDK, Figure 1(b)) [3], which is a soluble precursor compound of PEN. This compound can be photochemically converted to PEN in thin films, which exhibit a field-effect mobility comparable to that of vapor-deposited films [4]. Nevertheless, the film quality in terms of crystallinity and grain size is significantly low, which requires a more detailed analysis of the molecular aggregation structure.

In this study, infrared p-polarized multiple-angle incidence resolution spectrometry (pMAIRS) [5] and two-dimensional grazing incidence X-ray diffraction (2D-GIXD) are employed to analyze the molecular aggregation structure in the photoconverted PEN film. The combination of 2D-GIXD and pMAIRS has readily revealed that the photoconversion product (PEN) exhibits crystalline polymorphism in the films, in which the so-called bulk phase is the major component.

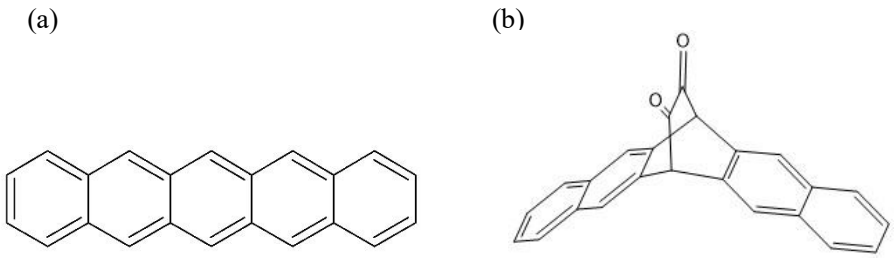

Figure 1 Chemical structures of pentacene (a) and 6,13-dihydro-6,13-ethanopentacene-15,16-dione (b).

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