

P13. Pressure Induced Changes in Aggregation Structures of Polyimide Films Probed by Florescence Spectra

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Polyimides (PI) are widely used as high-performance engineering plastics exhibiting high thermal stability and mechanical strength. Recently, PIs having isomeric structures have attracted interests due to their unique thermal and optical properties. We have reported the relationships between the aggregation structures and optical properties of aromatic PIs analysed by synchrotron wide-angle X-ray diffraction and optical spectroscopy at very high pressure up to 8 GPa [1-3]. In this study, pressure-induced changes in aggregation structures of PIs having bent structures in the main chains were investigated based on the fluorescence spectra at elevated pressures.

The structures of PIs used in this study are shown in Fig.1a. To generate high pressure up to 8 GPa, PI films were loaded into a diamond anvil cell (DAC) (Fig. 1b). The fluorescence spectra of aBPDC-3HPA PI under high pressures are shown in Fig. 2a. A significant reduction in the fluorescence emitted from the end group (3-HPA) was observed, which is originated from the enhanced intermolecular energy transfer due to the compression of inter-chain free volume. The normalized fluorescence intensities of sBPDC-3HPA and aBPDC-3HPA PIs are plotted against the pressure (Fig. 2b). The latter PI having a bent structure showed more significant reduction, indicating a looser aggregation structure than the former. As a consequence, fluorescence properties are useful to examine the amount of free volume at atmospheric pressure as well as the pressure-induced variations in aggregation structures of PIs having isomeric structures.

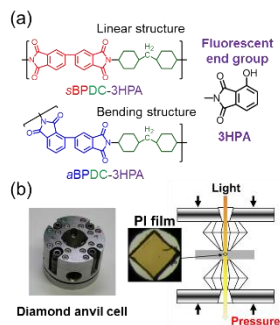


Fig. 1. (a) Molecular structure of PIs and (b) schematic illustrate of DAC.

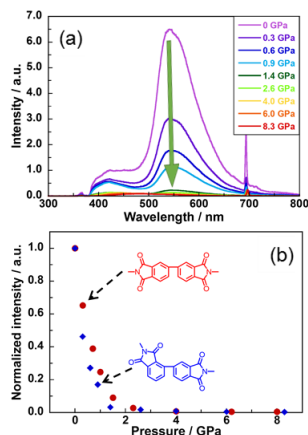


Fig. 2. (a) Fluorescence spectra of aBPDC-3HPA under high pressure. (b) Intensities of fluorescence peaks of s, aBPDC-3HPA as a function of pressure.

Keywords: Polyimide, High pressure, Aggregation structure, Fluorescence.

References: 1) K. Takizawa, J. Wakita, S. Azami, S. Ando: *Macromolecules*, **2011**, 44, 349-359. 2) *ibid.* **2012**, 45, 4764-4771. 3) K. Takizawa, H. Fukudome, Y. Kozaki, S. Ando *Macromolecules* **2014**, 47, 3951-3958.