EFFECTS OF SOLVENTS AND POLYMERIZATION TIME ON THERMOCHROMIC BEHAVIORS OF POLYDIACETYLENE ASSEBLIES PREPARED FROM DIAMIDODIACETYLENE MONOMERS

KHANANTONG Chanita, CHAROENTHAI Nipaphat, WACHARASINDHU Sumrit, SUKWATTANASINITT Mongkol, TRAIPHOL Rakchart

Nakhon Sawan Rajabhat University, Department of Chemistry, Faculty of Science and Technology, Nakhon Sawan, Thailand

Abstract

In this study, we investigate color-transition behaviors of polydiacetylene (PDA) assemblies, prepared from two types of diamidodiacetylene monomers. Structures of PDA assemblies are modified by varying length of alkyl linkers, which are ethyl and hexyl, between the diamide groups.1 Different solvents including water, butanol and decane are used as media. The variation of solvent properties results in PDA assemblies with different morphologies and color-transition behaviors. The PDA assemblies in water exhibit a reversible blue/red color-transition upon increasing temperature. The increase of alkyl linker length also causes the increase of color-transition temperature. When the PDA assemblies are prepared in butanol or decane, the sheet-like structure with high ordering is obtained. The color-transition temperature is also higher compared to the aqueous system. The magnitude of color reversibility, however, decreases in these solvents. This behavior arises from the swelling of solvents into inner layer of the PDA assemblies. When the solvents are removed from the system, thin films of the PDA assemblies still exhibit fully reversible thermochromism. Their color reversibility persists up to 45 oC. The changes of molecular packing and segmental interactions of the PDAs in different states are followed by differential scanning calorimetry and infrared spectroscopy. The photo-polymerization process of PDA assemblies also exhibits different behaviours depending on type of the solvents. Furthermore, we have found that the variation of polymerization time significantly affects the color-transition temperature of the resultant PDA assemblies. Our results provide a fundamental knowledge about the experimental factors affecting the thermochromic properties of the PDA assemblies.

Keywords: Polydiacetylene, thermochromism, color transition, nano-sensor

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