Electrochemical and Optoelectronic Characterization of Poly[2,5-Dialkoxy-p-Phenyleneethynylene-2,7-(9,9-Fluorene)]s with 7-Oxy-4-Methylcoumarin Side Groups

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Abstract — Two new poly[2,5-dialkoxy-p-phenyleneethynylene-2,7-(9,9-dihexylfluorene)]s (PPEF) consisting of conjugated emitting chromophores of the backbone and pendant hexyloxy groups (P1) or pendant 7-oxygen-4-methylcoumarin (OMC) chromophores via flexible spacer (P2), have been successfully prepared and their electrochemical and optoelectronic properties are investigated. The emission of P2 in solution is similar to model polymer (P1), and they show peak at 445 nm, which is attributed to PPEF backbone. Accordingly, efficient energy transfer from the OMC chromophores to PPEF backbone occurred readily in P2. The HOMO and LUMO energy levels of the two polymers have been estimated from their cyclic voltammograms. All the observations directly prove that the oxidation starts at the hole transporting segments of main chain. The electron affinity can be enhanced by introducing isolated electron-transporting side groups that lead to charges injection balance.

Keywords: Conjugated polymers, cyclic voltammograms, HOMO and LUMO energy

1. INTRODUCTION

The electrochemical and optoelectronic properties of a number of different conjugated polymers have been investigated [1-17]. Among them, conjugated polymers contain phenylene [e.g. poly(p-phenylene)s (PPP) [18], polyfluorene (PF)] [19], and phenylenevinylene [e.g. poly(p-phenylenevinylene) (PPV)] [20] in the conjugated backbone have been widely studied for electrochemical and optoelectronic applications, only a few groups studied the electrochemical and optoelectronic properties of phenyleneethynylene [e.g. poly(p-phenyleneethynylene)s (PPE) [21] and poly(2,7,9,9-di-2-ethylhexylfluorenylene ethynylene) (PFE) [22] in the conjugated polymers backbone, and they were generally not considered to be a promising emitting layer for OLED devices [23].

2. EXPERIMENTAL

Monomers 1, 2, 3 and model compounds M1 were synthesized and purified by procedures reported previously [24-26].

A typical polymerization procedure described as follows: To a mixture of toluene (7 mL) and diisopropylamine (3 mL) were added with 2,7-diethynyl-9,9’-dihexylfluorene (3,