DOCTORAL THESIS

Synthesis and characterization of conductive and soluble side-chain blue fluorescent polymers

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Synthesis and Characterization of Conductive and Soluble Side-Chain Blue Fluorescent Polymers

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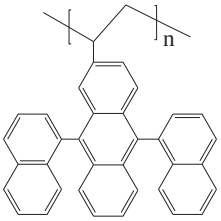
Abstract

Semiconducting polymers had been well studied and applied in many research areas. They are such as electroactive actuators, electrochromic materials, microwave-absorbent coatings, polymer solar cells, polymer light-emitting diodes, etc. Traditional semiconductors are metals/oxides and they are expensive, toxic and harmful to the environment. Compared to the traditional π-conjugated main-chain polymers, side-chain conductive polymers have a lower volume percentage of the charge transport moieties yet they possess advantages such as excellent mechanical strength, good rheological properties, solubility in common organic solvents and purer emission hue. Furthermore, the performances of the side-chain semiconducting polymers can be engineered easily by changing their composition or by choosing an appropriate additional polymerization method. As a result, several series of soluble, semiconducting and luminescent side-chain homopolymers and copolymers have been synthesized and characterized.

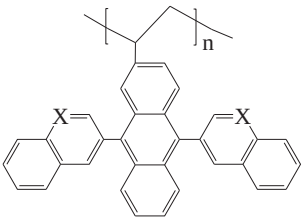
In this thesis, several series of vinyl conductive polymers have been prepared using the facile solution free radical, anionic and atom transfer radical polymerization methods. The novel polymers including the homopolymer **P(ADN)**, two highly soluble homopolymers **P(2ADN)** and **P(3ADQ)**, two series of ADN moities containing copolymer **P(ADN-co-S)** and **P(ADN-co-VK)**, a series of pyrene moieties containing copolymer **P(PyPA-co-VPy)** and two novel amphiphilic BAB-type block copolymers, **ADN-PEG3400-ADN** and **Py-PEG3400-Py** which contain blue and greenish-blue fluorescent moieties.

The chemistry and physical properties of the intermediates, the resulting polymers were characterized using nuclear magnetic resonance spectroscopy

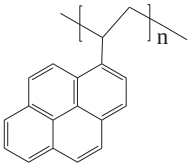
(NMR), matrix-assisted laser desorption ionization time-of-flight mass spectrum (MALDI-TOF MS), fourier-transform infrared spectroscopy (FT-IR), elemental analysis (EA), gel permeation chromatography (GPC), thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), UV-Visible spectroscopy (UV-Vis), photoluminescence spectroscopy (PL), cyclic voltammetry (CV), X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), and fabrication of polymer light-emitting diodes (PLED) and their measurements.



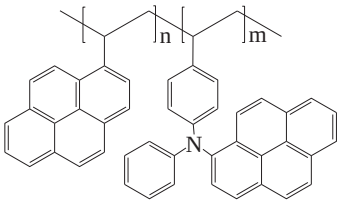
P(ADN)



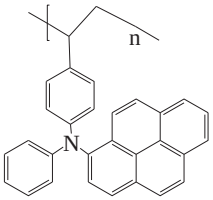
X = CH P(2ADN)
N P(3ADQ)



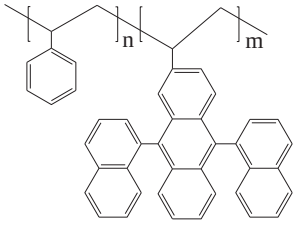
PVPy



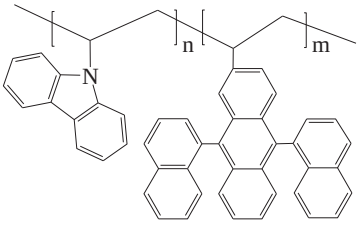
P(PyPA-co-VPy)



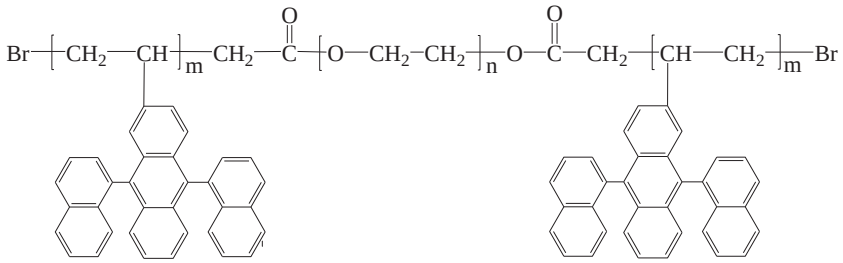
P(PyPA)



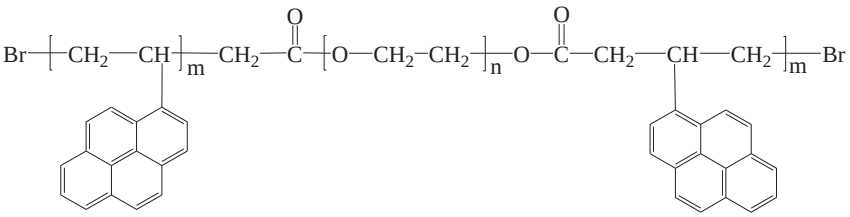
P(ADN-co-S)



P(ADN-co-VK)



ADN-PEG3400-ADN



Py-PEG3400-Py

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