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Polymerization

An Attempt of Double Step Polymerization of 3,4-Ethylenedioxythiophene in Cholesteric Liquid Crystal

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ABSTRACT

Double step polymerization combining chemical oligomerization and electrochemical polymerization of 3,4-ethyelenedioxythiophene was carried out in cholesteric liquid crystal to produce optically active poly(3,4-ethylenedixoythiphene). Polarizing optical microscopy was carried out to investigate the polymer film.

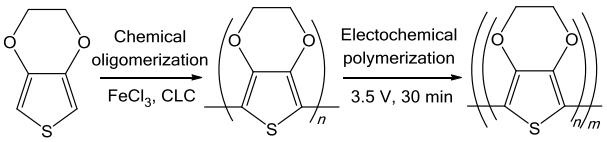
Keywords: conjugated polymers, chemical oligomerization, electrochemical polymerization

Introduction

Poly(3,4-ethyelendioxythiophen) (PEDOT) is one of the most attractive conjugated polymers due to its high conductivity, air stability and high transparency at oxidized state[1–3]. Preparation of chiroptical materials consisting of conjugated polymers is challenging issue due to the facile tunability of optical property by external stimuli such as solvent, pH, electricity and so on[4–6]. Electrochemical polymerization of 3,4-ethyelendioxythiophen (EDOT) in cholesteric liquid crystal, however, produces no optically active PEDOT due to its low aspect ratio of chemical structure. In this paper, double step polymerization combining chemical oligomerization and sequential electrochemical polymerization was carried out to produce optically active PEDOT.

Experimental

EDOT and tetrabutylammonium perchlorate were dissolved in cholesteric liquid crystal consisting of 4-cyano-4'-pentylbiphenyl and cholesteryl oleyl carbonate. Before the electrochemical polymerization, iron(III) chloride ($FeCl_3$) was added in the electrolyte solution to afford oligomers of EDOT. Then, direct current of 3.5 V was applied for 30 minutes to produce PEDOT. The obtained PEDOT film was washed with acetone.



Scheme 1. Double step polymerization combining chemical oligomerization and electrochemical polymerization of EDOT in cholesteric liquid crystal.

Results and discussion

Polarizing optical microscopy observations for the film results in no apparent transcription of fingerprint texture from cholesteric liquid crystal. This may be due to the uncontrollable oligomerization process at the present stage. Quest for appropriate condition, eg. oligomerization time to adjust oligomer size (monomer, dimer, and trimer) to obtain good affinity with matrix liquid crystal and adjustment of concentration of Fe(III)

catalyst is required.

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