CARATTERIZZAZIONE ELETTOCHIMICA ED ELETTROPOLIMERIZZAZIONE DI TETRAIACELENI VARIAMENTE FUNZIONALIZZATI PER APPLICAZIONI IN OTTICA NON LINEARE

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1. Introduction

In the last decade macromolecular system have been extensively used for applications such as the nonlinear optical (NLO) properties, electrooptics, and photoconductivity. The most well-known examples are polythiophene (PT) and polyarylenethiophene (PAT) derivatives with different core structures, such as TATC, TAA, TATC and TATC. These systems are characterized by a strong electronic conjugation which can be efficiently delocalized along the backbone. However, the NLO properties of these systems are limited by their inherent low lying electronic states, which are too high to provide an efficient second harmonic generation (SHG) response. Therefore, the development of new classes of NLO materials with high efficiency and good processability is highly desired.

2. Experimental

The monomers were synthesized by the reaction of 4,7-dihaloaromatic compounds with thiophene derivatives. The polymers were obtained by chemical or electrochemical polymerization. The electrochemical properties were studied by cyclic voltammetry (CV) and linear sweep voltammetry (LSV). The NLO properties were measured by the second harmonic generation (SHG) technique.

3. Results and Discussion

The CV and LSV curves of the monomer and polymer samples showed the presence of redox waves corresponding to the oxidation and reduction of the conjugated backbone. The oxidation potentials of the polymers were found to be higher than those of the monomers, indicating a increase in the conjugation length. The LSV curves showed a decrease in the peak-to-peak separation with increasing polymerization time, suggesting a decrease in the interchain interactions.

The SHG measurements revealed a significant increase in the SHG signal with increasing polymerization time, indicating a strong enhancement of the NLO properties. The SHG efficiency was found to be dependent on the polymerization conditions, such as the monomer concentration, polymerization temperature, and oxidation potential.

4. Conclusion

The results presented in this study demonstrate the potential of electrochemical polymerization of thiophene derivatives for the synthesis of NLO materials with improved properties. Further studies are needed to optimize the polymerization conditions and to improve the processability of the resulting polymers.

References


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