Synthesis and Characterization of Soluble Pentacenes

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Introduction

During the last few years, the development of organic thin film transistors (OTFTs) has attracted much interest. The production of OTFTs has been studied because organic molecules offer the opportunity of deposition over large surface areas and are compatible with flexible plastic substrates. Although organic materials have the key advantage of potentially simple and low temperature thin film processing, using techniques such as spin coating, stamping or ink-jet printing methods.

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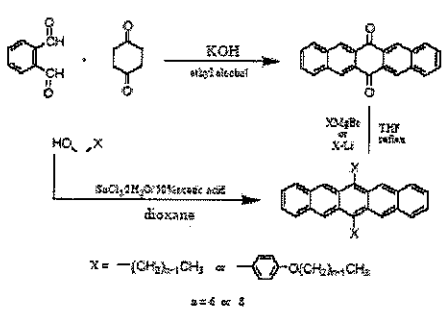
Thin film field-effect transistors using pentacene as the active semi-conductor have shown charge transport mobility in the range of 0.005-2.1 $cm^2V^{-1}s^{-1}$ and on/off current ratios larger than 10^5, but, pentacene practically used in OTFTs gives rise to problems mainly due to its very low solubility.

In this work, to make up for those problems we designed and synthesized soluble pentacenes and characterized their electrical properties.

Experimental

Synthesis. The pentacenequinone is conveniently prepared by condensation of o-phthalaldehyde and 1,4-cyclohexadione. First, o-phthalaldehyde and 1,4-cyclohexadione were dissolved in C_2H_5OH at room temperature. KOH was added to it. The reaction mixture was stirred at room temperature for overnight. Next, pentacenequinone were converted to the corresponding pentacenediols using the Grignard reaction. Grignard reagent was added to a ice-cooled suspension of pentacenequinone in THF under nitrogen atmosphere. The mixture was refluxed and stirred at 60℃ for overnight. The resulting mixture cooled and then treated with an aqueous solution of HCl, extracted with CH_2Cl_2 and washed with H_2O. After drying over $MgSO_4$ and evaporation in vacuo, the product was isolated by column chromatography.



Scheme 1. Synthetic route to soluble pentacenes.

Characterization. IR and NMR spectra were obtained by Jasco 300E FT/IR and Bruker DPX 200 MHz NMR spectrometers, respectively. The compounds of thermal and optical properties were measured by DSC (Du Pont TA 910 DSC), TGA (TA instruments TGA Q500), and UV/Vis-spectra (Scinco S-1100).

Results and discussion

The obtained alkyl substituted products by reaction between Grignard reagent and pentacenequinone were identified by using a IR and a NMR-spectroscopy. The obtained compounds were characterized by means of DSC, TGA and UV spectroscopy. By introduction of alkyl group, it was observed that the decrease of melting temperature and blue shift of UV spectrum. Also the solubility was improved greatly compared with pentacenequinone.

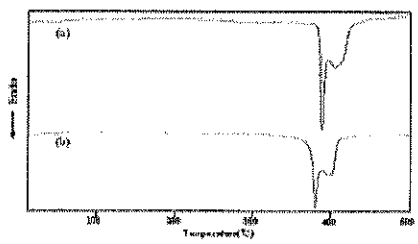


Figure 1. DSC thermograms of (a) 6,13-pentacenequinone and (b) 6,13-dihexyl-6,13-dihydropentacene on the heating scans (heating rates = 20℃/min).

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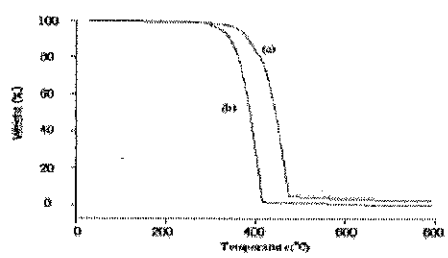

Figure 2. TGA thermograms of (a) 6,13-pentacenequinone and (b) 6,13-dihexyl-6,13-dihydropentacene (heating rates = 20℃/min).

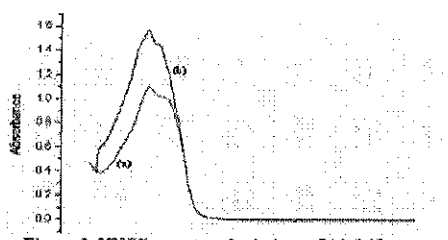

Figure 3. UV/Vis-spectra of solutions of (a) 6,13-pentacene-quinone and (b) 6,13-dihexyl-6,13-dihydropentacene in $CHCl_3$.

References

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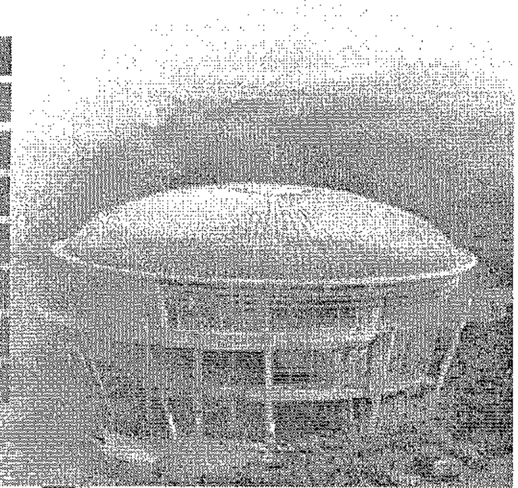

Poster Session - October 12 (Thursday)

[Chair: Hyun Jong Paik, Yeong Soon Gal]
Room 301
Presentation Time: 12:30~14:00
Poster display Time: 10:30 ~ 17:30

A. Advanced Polymers for Emerging Technologies

A1. Polymers for Electronics and Photonics

2A1-PO-075
Synthesis and Characterization of Alternatively Poly(indenofluorene-co-quarter thiophene)
Pachagounder Sakthivel, Sung-Jin Park, Yun-Hi Kim and Soon-Ki Kwon

2A1-PO-076
Synthesis and Characterization of Poly[3-(methylthio)thiophene] by Reductive Coupling Method
Sang-Ho Park, Jin-Young Bae

2A1-PO-077
Synthesis and Characterization of Soluble Pentacenes
Min-Hye Kang, E-Joon Choi, and Jae-Hoon Kim

2A1-PO-078
Synthesis of PMMA Copolymer with Photo-crosslinkable Side Groups as the Gate Insulator

2A1-PO-086
Characteristics of Polypyrrole Synthsized by Interfacial Polymerization
Sang Jae Lee, Kwang Hyun Lee, Chun Ki Kim, Eung Ju Oh

2A1-PO-087
Electrical Properties of Water-soluble and Self-doped Conducting Graft Polyaniline
Youn Kyoo Lee, Won Ho Jo

2A1-PO-088
Fabricate Conductive Thin Film Using Various Patterning Technique
Sang Hoon Son, Young Rock Kwon, Bo Ram Jung, Oh Hyun Sung, Seok Ki Kim, Jung Min Ko, Seung Hyun Cho and Jun Young Lee

2A1-PO-089
Polythiophene Nanoparticles Prepared by Fe^{3+} Catalyzed Oxidative Chemical Polymerization in the Aqueous Medium
Sun Jong Lee, Jung Min Lee, In Woo Cheong, and Jung Hyun Kim

2A1-PO-090
Preparation and Characterization of Polypyrrole-Nanoclay Nanocomposites
[illegible], Autchareeom Thirumthad

2A1-PO-091
Synthesis and Characterization of Micron-size Poly(styrene-co-divinylbenzene) Copolymer Particles for Anisotropic Conductive Polymer Balls
Ki-Beom Um, Chi-Hee Ahn, Jong-Pyo Wu

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