

Alkyl chains have been demonstrated to play important roles in intermolecular interactions and supramolecular self-assembly. Generally, alkyl chains are attached onto conjugated polymers as solubilizing groups to ensure polymer solubility in organic solvents. Moreover, the chain type and length as well as substituting position on conjugated polymers have crucial consequences on molecular packing and thin film morphology, and hence on device performance. Herein we describe the preparation of new diketopyrrolopyrrole (DPP)-based conjugated polymers consisting with different alkyl chains in the DPP unit and its use in the solution-based fabrication of polymeric thin film transistors.

2PS-255 박영호

Copper Nanowire for Transparent Electrodes

박영호, 인인식[†] 한국교통대학교

In modern times, ITO has been used as a transparent conducting materials for various transparent electrode, solar cells and touch panels. Because of its brittleness property, inefficient processing, and high cost, several researches reported as the replacement of ITO by using various types of metal nanowires, carbon nanomaterials, and conducting polymers, etc. Nowadays, Metal nanowire, as an enormous substitution of ITO because of their good electrical conductivity and optical transmittance. Herein, we were tried to demonstrate the research about copper (Cu) nanowire which has been act as a conducting materials with less oxidative property.

2PS-256 박은유

Synthesis and characterization of new non-fullerene type electron-accepting material for P3HT-based polymer solar cells

박은유, 김희은, 김지훈, 박종백, 신원식[†], 윤성철[†], 황도훈[†] 부산대학교; [†]한국화학연구원
9,9'-Bifluorenylidene (9,9'BF) was promising structure of non-fullerene-type electron acceptors for bulk-heterojunction polymer solar cells (PSC). We synthesized new 9,9'BF derivatives, 2,2',7,7'-tetra(9,9'-diethyl-9H-fluorene)-9,9'-bifluorenylidene (TFBF). TFBF was synthesized from 2,7-di(9,9'-diethyl-9H-fluorene)-9H-fluorene-9-one by reductive dimerization using Lawesson's reagent. The measured optical band gap, the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) of TFBF were 2.32, 5.81, and 3.49 eV, respectively. The photoluminescence (PL) spectra of P3HT solution in chloroform were measured at different TFBF concentrations. The PL intensity of the P3HT solution decreased upon increasing the TFBF concentration. P3HT based photovoltaic devices were fabricated using TFBF as electron acceptor. TFBF possessed relatively high LUMO level promising the high Voc comparing the PC60BM devices (~0.65 V).

2PS-257 박종광

Synthesis and Characterization of Benzodithiophene Derivative for Efficient Solar Cells (OPVs)

박종광, 김윤희[†], 하종진, 홍정아, 김 란, 권순기 경상대학교

Polymer solar cells (PSCs) have attracted considerable attention because of their advantages of low cost, light weight, and flexibility in large area applications by ink-jet printing and roll to roll solution processes. The polymeric materials were efficiently synthesized through a Suzuki coupling reaction. The polymers have low band gap and good inter molecular interaction and bulky alkyl group was introduced for soluble system. The material was confirmed by ¹H NMR, ¹³C NMR and IR spectra. The thermal properties of the polymers were determined by thermogravimetric analysis (TGA) and differential scanning calorimeter (DSC). The optical-electro properties was performed by UV-visible absorption and cyclic voltammetry (CV). In other to study of film morphology and the crystallization, the X-ray diffraction (XRD) and atomic force microscopy (AFM) were investigated.

2PS-258 박종현

Synthesis and Characterization of Small Molecule Based on Diketopyrrolopyrrole (DPP) and Its Application of Organic Solar Cells

박종현, 임경은, 김주현[†] 부경대학교

Over the past decades, π -conjugated polymers have been commonly applied as an active layer for organic photovoltaics (OPVs). Recently, many researches have been focused in small molecules as active layer materials due to their advantages of the ease synthesis and purification. Herein, we synthesized a series of new donor-acceptor type small molecules based on diketopyrrolopyrrole (DPP) with different alkyl chain as electron deficient unit and phenyl carbazole as electron rich unit. The ultra-visible spectra showed that the intensity of absorbance increased after annealing processes. Also, the device performances were improved by annealing. In this presentation, we will report the synthesis, opto-electrochemical properties and photovoltaic properties.

2PS-259 박준우

Crosslinkable materials for OLED

박준우, 김범준[†] 한국과학기술원

Crosslinkable materials for OLED

2PS-260 박지은

Synthesis and Characterization of π -Conjugated Cruciform Molecule bearing Diketopyrrolopyrrole Peripheral Moieties

박지은, 윤승희, 염현아, 신지철, 이태완, 조민주, 최동훈[†] 고려대학교

Compared with linear organic conjugated oligomers and polymers used in organic field-effect transistor (OFETs), cruciform molecules have a number of advantages including the ability to spatially control the active components. The synthesis of π -

-conjugated cruciform molecules raises the possibility of creating donor or acceptor derivatives that are fully tethered to the planar core. Furthermore, the solubility problem in conjugated oligomer and polymer is totally overcome under a dendritic architecture. In this work, we designed and synthesized new low bandgap π -conjugated cruciform molecules containing diketopyrrolopyrrole peripheral moieties. The molecular energies and geometry were investigated through theoretical calculation. Thermal analysis, absorption spectroscopy, and emission spectroscopy were employed to characterize the materials properties. We will consider the functionality as a semiconductor for specific applications.

2PS-261 박지훈

Photostable wide band-gap based organic thin-film transistor for multi-purpose application

박지훈, 조천규[†], 임성일[†] 연세대학교; [†]한양대학교 화학과

Small molecule pentacene has attracted much attention due to its ambient stabilities as an organic semiconductor. Following solid pentacene films, other small molecules were reported to improve the property of pentacene layer. Indolo[3,2-b]carbazole and DNTT (dinaphtho-[2,3-b:2',3'-]thieno[3,2-b]thiophene) are the examples which were respectively reported recently. Even though the HOMO-LUMO gap of indolo[3,2-b]carbazole and DNTT are higher than that of pentacene, the photostability of such organic layers has hardly been considered yet. Here, we have implemented 8,16-dihydrobenzo[a]benzo[6,7]indolo[2,3-h]carbazole (BBICZ) with HOMO-LUMO gap of ~2.95 eV, to fabricate a new small molecule-based OTFT. The field-effect mobility of the OTFT turns out to be ~0.17 cm²/V s which is lower than that of the pentacene OTFT on the same structure, however it certain displays good photostability. We also fabricated an image sensor pixel where our BBICZ-OTFT and pentacene diode are combined.

2PS-262 박한욱

Synthesis and characterization of Donor-Acceptor Conjugated Copolymers based on Naphthalene and Quinoxaline derivatives

박한욱, 엄승훈, Sushil Bagde, Pranabesh Dutta, 이우형[†], 강인남[†], 이수형[†] 전북대학교; [†]가톨릭대학교

Two new polymers based on quinoxaline, poly[1,5-dicycloxy-naphthalene-alt-5,5'-(5,8-dithiophen-2-yl)-2,3-bis(4-octyloxyphenyl)quinoxaline (PNQx-p) and poly[1,5-dicycloxy-naphthalene-alt-5,5'-(5,8-dithiophen-2-yl)-2,3-bis(4-octyloxyphenyl)quinoxaline (PNQx-m), were synthesized by Suzuki coupling reaction. Optical, thermal and electrical properties of the polymers were investigated by UV absorption, photoluminescence, TGA and cyclic voltammetry. PNQx-p and PNQx-m have comparable optical band gap (~2eV) and almost similar deep HOMO energy levels (-5.59 and -5.61eV, respectively). The device of PNQx-m blended with PC71BM(1:2) showed the best power conversion efficiency(PCE) of 2.29% with an open-circuit voltage of 0.93 V. The PCE of PNQx-m:PC71BM(1:2) was improved to 2.95% by using 1,8-diiodooctane(0.25% v/v) as an additive.

2PS-263 박형일

Selective Enhancement of Carrier Transport in Bulk-Heterojunction Organic Solar Cells with B- or N-Doped Carbon Nanotubes

박형일, 이주민, 김성욱[†] KAIST

We present the remarkable performance improvement of organic solar cells upon incorporating N- or B-doped carbon nanotubes (CNTs) into the organic semiconductor active layer. A small amount (0.2-5.0 wt%) of doped multi-walled CNTs are added to the bulk-heterojunction of poly(3-hexylthiophene) (P3HT) and 1-(3-methoxycarbonyl)propyl-1-phenyl[6,6]C61 (PCBM). Unlike undoped metallic multi-walled CNTs, which cause undesired electron-hole recombination, N- or B-doped CNTs uniformly dispersed in the active layer selectively enhance electron or hole transport, respectively, and eventually help carrier collection. Specifically, the incorporation of 1.0 wt% B-doped CNTs results in a balanced electron and hole transport and accomplishes a power conversion efficiency improvement from 3.0% (conventional control cells without CNTs) to 4.1%.

2PS-264 박홍수

Enhanced Performance of Polymer Solar Cells with PSSA-g-PANI/Graphene Oxide as Hole Transport Layer

박홍수, 정의혁, 정재웅, 이재욱[†], 김경태, 조원호[†] 서울대학교; [†]재료연구소

Hole transport layer (HTL) has always been used for high performance polymer solar cells (PSCs) because of efficient hole extraction from active layer to anode and lowering the contact resistance between active layer and anode. Although PEDOT:PSS has commonly been used as a HTL, it has detrimental problems with low electrical conductivity, acidic nature and large aggregates. As an alternative to PEDOT:PSS, we previously synthesized poly(styrenesulfonic acid)-graft-polyaniline (PSSA-g-PANI) which is a self-doped conducting copolymer, and reported significant enhancement of the power conversion efficiency (PCE) of PSCs when it was used as a HTL of PSCs. In this work, we prepared PSSA-g-PANI/graphene oxide (GO) composite by adding GO into PSSA-g-PANI and used the composite as HTL of PSCs for the purpose to further improve the PCE. When the PSSA-g-PANI/GO (95/5) composite was used as HTL, the PCE of PSCs was improved by about 10% as compared to that without GO.

2PS-265 빈센트

Synthesis of Squaraine Donor Materials and its Application in Solar Cells

빈센트, 김진곤[†] 포항공과대학교

Squaraine compounds are currently investigated as high performance active components



Enhanced Performance of Polymer Solar Cells with PSSA-g-PANI/Graphene Oxide as Hole Transport Layer



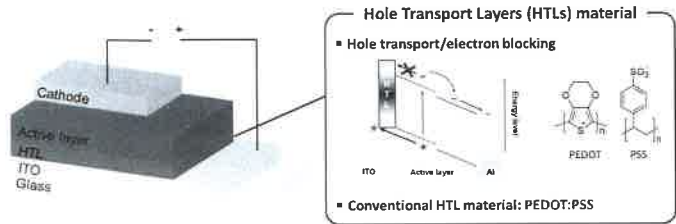
박흥수, 정의혁, 정재용, 이제욱¹, 김경태, 조원호*

서울대학교 공과대학 재료공학부

¹ 한국기계연구원 부설 재료 연구소

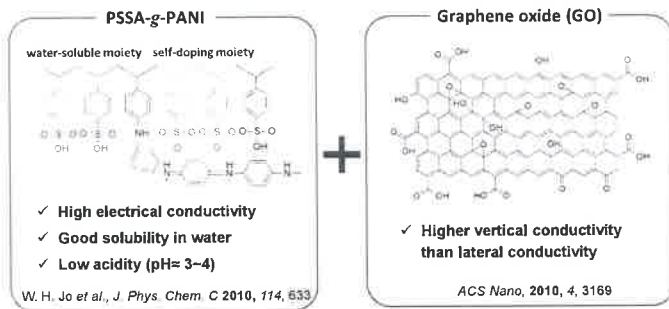
Introduction

❖ Disadvantages of PEDOT:PSS for polymer solar cells



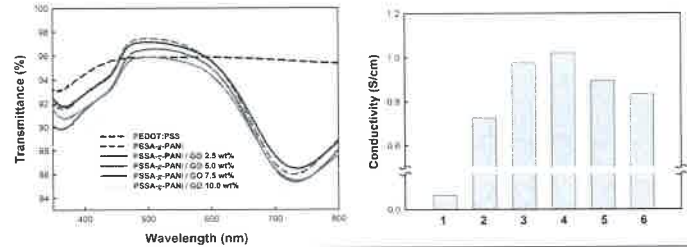
- ✓ Low electrical conductivity (≈ 0.008 S/cm)
- ✓ Corrosion of ITO by acidic nature ($\text{pH} \approx 1$)

❖ Alternatives to PEDOT:PSS as HTLs



High performance PSCs

❖ Optical and electrical properties

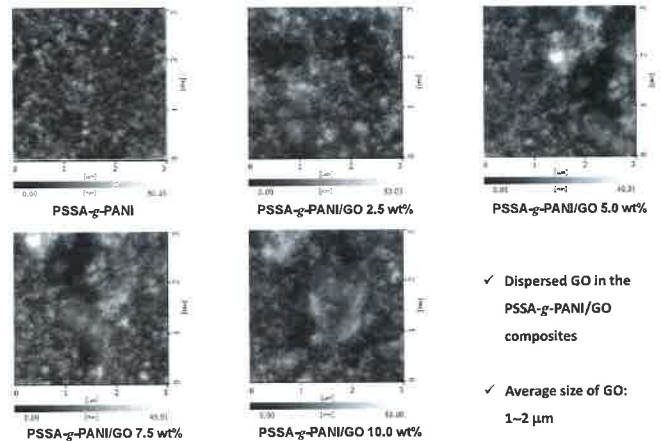


	Transmittance (%) at 550 nm	Conductivity (S/cm)
1 PEDOT:PSS	95.9	0.008
2 PSSA-g-PANI	97.1	0.725
3 PSSA-g-PANI with GO (2.5 wt%)	96.8	0.976
4 PSSA-g-PANI with GO (5.0 wt%)	96.3	1.020
5 PSSA-g-PANI with GO (7.5 wt%)	95.6	0.896
6 PSSA-g-PANI with GO (10.0 wt%)	95.3	0.833

- ✓ Increasing ratio of GO to PSSA-g-PANI \rightarrow decreasing transmittance of the composites
- ✓ Higher electrical conductivity of PSSA-g-PANI with GO than that without GO

❖ Morphology study

• Atomic force microscopy images



- ✓ Dispersed GO in the PSSA-g-PANI/GO composites
- ✓ Average size of GO: 1-2 μm

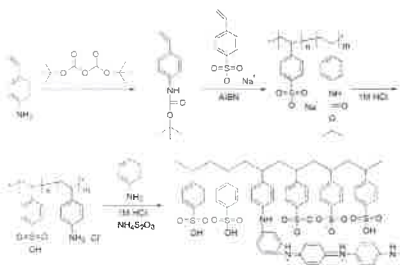
Objectives

- To improve the electrical conductivity of poly(styrenesulfonic acid)-graft-polyaniline (PSSA-g-PANI) by adding GO into PSSA-g-PANI
- To investigate photovoltaic properties of PSCs with PSSA-g-PANI/GO composites as hole transport layers

Results

❖ Preparation of PSSA-g-PANI/GO composites

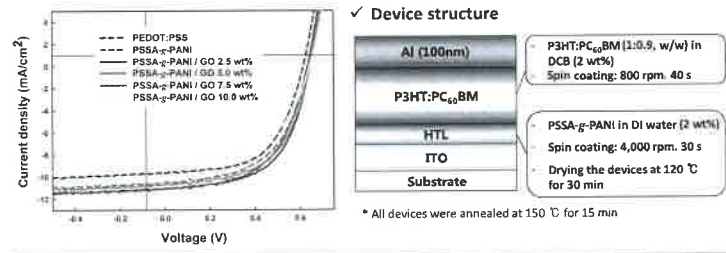
• Synthetic scheme of PSSA-g-PANI



Procedure

1. Dispersion of GO via bath-type sonication for 1 hr
2. Centrifugation at 4000 rpm for 10 min to remove aggregated GO
3. Adding PSSA-g-PANI into GO solution and stirring for 24 hr

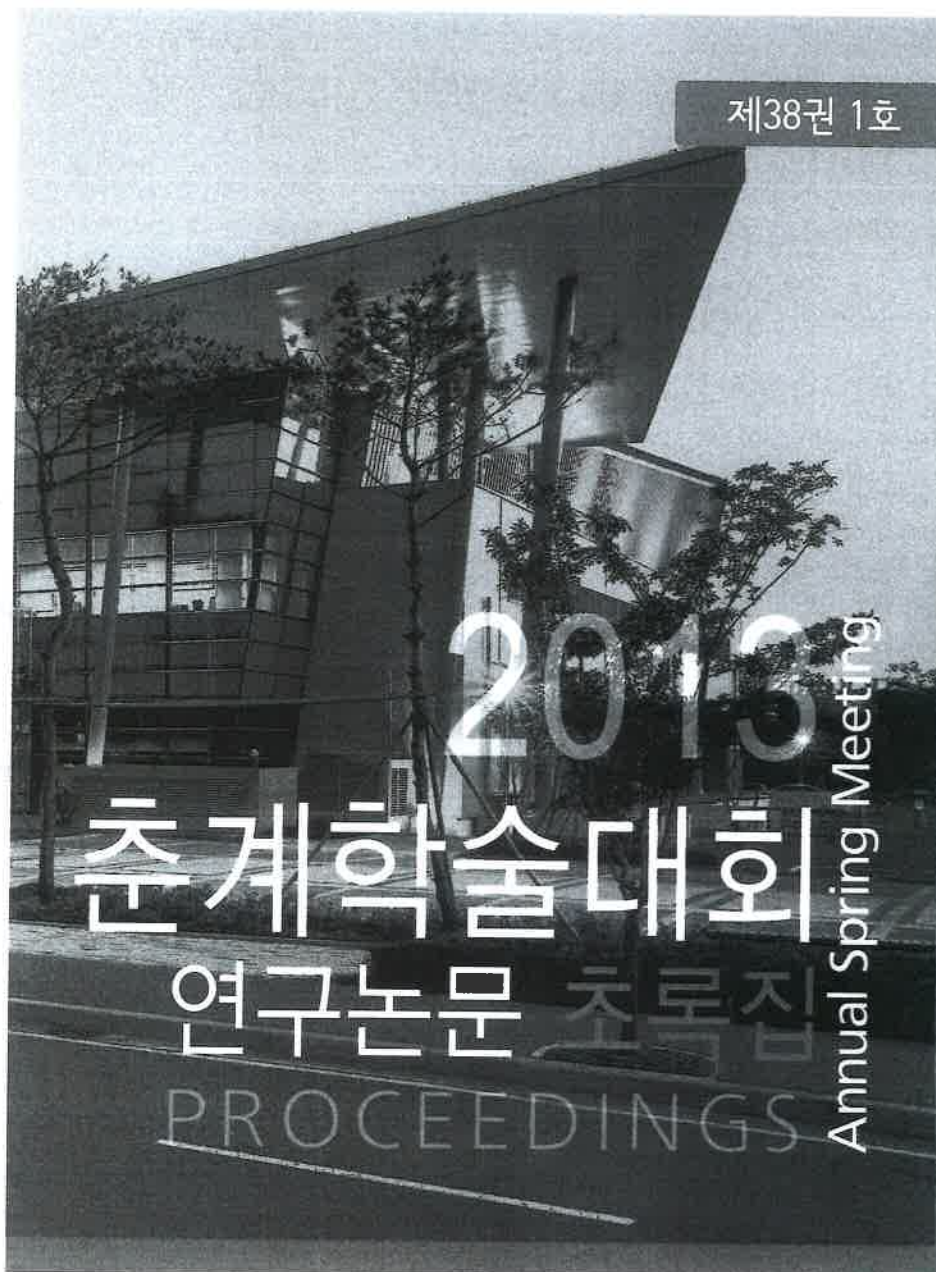
❖ Photovoltaic properties



	V_{oc} (V)	J_{sc} (mA/cm^2)	FF	PCE (%)	R_{sh} (Ωcm^2)	R_s (Ωcm^2)
PEDOT:PSS	0.62	9.66	0.57	3.42	1171.7	8.7
PSSA-g-PANI	0.64	10.51	0.55	3.68	720.8	8.6
PSSA-g-PANI with GO (2.5 wt%)	0.64	11.06	0.58	4.14	1799.9	7.2
PSSA-g-PANI with GO (5.0 wt%)	0.63	10.97	0.56	3.89	580.2	8.0
PSSA-g-PANI with GO (7.5 wt%)	0.65	10.68	0.56	3.92	734.1	7.6
PSSA-g-PANI with GO (10.0 wt%)	0.64	9.38	0.54	3.25	556.5	9.6

Conclusions

- The electrical conductivity of PSSA-g-PANI is increased from 0.725 S/cm to 1.020 S/cm as GO is added.
- PSSA-g-PANI with GO (2.5 wt%) composite shows the best PCE of 4.14% which is improved by 15% as compared to that without GO.



2013 Annual Spring Meeting

춘계학술대회

연구논문 초록집

PROCEEDINGS

2013. 4. 11(Thu) - 12(Fri)



한국고분자학회
The Polymer Society of Korea



대전광역시
DAEJEON METROPOLITAN CITY

DIME 대전마케팅공사

일 정 표

4월 11일(목)

시간	행사	장소	비고
08:00-17:30	등록	1층 로비	
09:00-10:30	포스터 발표(I) (좌장: 박재형, 김범준) (IPS-1~1PS-337)	1층 다목적홀	포스터(I) 게시
10:30-11:10	[기조강연] PL-1 고분자 산업의 새로운 르네상스 유진녕, LG화학 (좌장: 정태현)	총회장	
11:10-11:50	[도레이고분자상 수상기념강연] PL-2 High Performance Polyimide Dielectrics and Semiconductors: Low-k dielectrics, LC-alignments and Electrical Memories 이문호, 포항공과대학교 (좌장: 장지영)		
11:50-12:50	[제 74회 정기총회(준계)] 1. 개회 2. 2013년도 학회상 시상 3. 회무보고 4. 2012년도 결산승인 5. 기타토의 6. 폐회		
12:50-14:00	점 심		
14:00-18:00	초청강연 및 연구논문 발표(I) (초청강연 55편, 구두발표 45편)	각 발표회장	
18:30	간담회 및 우수논문발표상 시상	간담회장	

4월 12일(금)

시간	행사	장소	비고
8:00-16:00	등록	1층 로비	
9:00-10:30	포스터 발표(II) (좌장: 양성윤, 강영종) (2PS-1~2PS-337)	1층 다목적홀	포스터(II) 게시
10:30-12:30	초청강연 및 연구논문 발표(II) (초청강연 28편, 구두발표 12편)	각 발표회장	
12:30-14:00	점 심		
14:00-16:00	초청강연 및 연구논문 발표(III) (초청강연 28편, 구두발표 12편)	각 발표회장	포스터(III) 게시
16:00-17:30	포스터 발표(III) (좌장: 김영진, 가재원) (3PS-1~3PS-337)	1층 다목적홀	