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In this work our attempts to prepare a hybrid material of semiconducting nanocrystal quantum dots (QDs) and polystyrene are explained. Previously organic memory cell devices have been reported with Au nanoparticles showing very high performances. CdSe QDs appear to possess the required fundamental properties to be used in such hybrid QD/polymer devices; attempts to date in this regard are none to our best knowledge. We report here the memory characteristics of an organic memory device with CdSe/ZnS QDs having cabazole based organic ligands blended with polystyrene deposited on aluminum substrates. Ligand selection was crucial because QDs with oleic acid ligands were practically unable to spread QDs uniformly throughout the QD:PS blend. The carbazole based ligands having alkyl substituents of different chain lengths presently used in this study successfully dispersed QDs uniformly throughout the blend.

3PS-139 전수지
Preparation and evaluation of new acceptor-donor-acceptor type conjugated molecules for organic solar cells

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Organic photovoltaics possess many advantages such as light-weight, low cost, facile fabrication for large area, and mechanical flexibility. However, there are still obstacles to achieve high power conversion efficiencies (PCE) because of the mismatch between the solar spectrum and the spectra of organic materials used in active layer. To overcome this absorption limitation, synthesizing new low band gap materials is proposed to improve PCE of organic solar cells. Generally, low band gap molecules consist of D (electron-donating unit) and A (electron-accepting unit) alternative structure. In this work, we have synthesized new low band gap A-D-A type molecules, and their optical and electrochemical properties will be presented along with their application to organic solar cells.

3PS-140 전우용
Crystal Growth of Organic Electro-Optic Phenolic Polyene Crystals

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넓은 전기광학 성질을 나타내는 유기결정, OH1(2-(3-(4-hydroxystyryl)-5,5-dimethylcyclohex-2-enylidene)-malononitrile)은 메탄올 내에서 넓은 준안정 영역 때문에 결정성장을 조절하는 것이 어려웠다. 또한 Knoevenagel condensation 방법으로 합성 중 생성되는 불순물들이 결정성장에 참여하여 단결정의 중요한 물리적인 성질에 영향을 끼쳤다. 본 연구에서는 몇몇 첨가물 인산을 이용하여 OH1 결정의 성장을 조절할 수 있었다. 인산 존재 하에서, OH1 결정의 준안정 영역이 크게 감소하면서 기핵이 더욱 빨라지는 것을 관찰할 수 있었다. 또한 indiumium 계열의 첨가물을 이용하였을 때 성장시킨 OH1 결정의 순도가 높아지는 것을 관찰할 수 있었다.

3PS-141 정대영
Enhanced Light Harvesting Efficiency by Förster Resonance Energy Transfer using Organic Blue Dye in Quasi-solid State DSSC

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The mechanism of DSSC is based on the injection of electrons from the photo excited dye into the conduction band of the semiconductor electrode. Thus, the light harvesting effect of dye plays an important role in capturing the photons and generating the electron/hole pair, as well as transferring them to the interface of the semiconductor and the electrolyte, respectively. We have demonstrated Förster resonance energy transfer (FRET) in the quasi-solid type dye-sensitized solar cells between organic fluorescence materials as an energy donor doped in fluorine polymer gel electrolyte and organic dye as an energy acceptor in quasi-solid electrolyte. The strong spectral overlap of emission/absorption of energy donor and acceptor is required to get high FRET efficiency. The judicious choice of energy donor allows the enhancement of light harvesting characters of energy acceptor in quasi-solid dye sensitized solar cells which increase the power conversion efficiency.

3PS-142 정미란
Highly Efficient and Stable Organic Photo-Sensitizers based on Triphenylamine with Multi-anchoring Chromophore for Dye-sensitized Solar Cells

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Organic dyes, because of their many advantages, such as high molar extinction coefficients, convenience of customized molecular design for desired photophysical and photochemical properties, inexpensiveness with no transition metals physical, and environment-friendliness, are suitable as photosensitizers for DSSC. In this paper, we successfully synthesized the chromophore containing multi-acceptor push-pull system from triphenylamine with thiophene moieties as a bridge unit. Organic dyes with a single electron acceptor and double acceptor system were also synthesized for comparison purposes. The photovoltaic performances of these dyes were compared, and the recombination dark current curves and the incident photon-to-current (IPCE) efficiencies were also measured in order to characterize the effects of the multi-anchoring groups on the open-circuit voltage and the short-circuit current.

3PS-143 정수훈
Lifetime enhancement of organic photovoltaic cells by using self-organized polymeric anodes

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Transparent electrode materials in organic optoelectronics have received the

great attention to replace conventional brittle inorganic oxide materials. Self-organized polymeric anode materials were prepared based on poly(3,4-ethylenedioxythiophene); poly(4-styrenesulfonate)(PEDOT:PS) in which 5wt% DMSO were added to enhance their conductivity. As a key component, perfluorinated ionomer(PFI) was included to achieve a high work function and hydrophobicity. They showed excellent tuning of work-function which enabled to outperform the conventional ITO. The maximum work-function of the anode is 5.8 eV which is the highest value among the flexible anodes which have been reported until now. Moreover, transparency was higher than 90 % in all the visible range. We applied these conducting polymer anodes to bulk-hetero junction organic photovoltaic cells(OPVs). The lifetime of the OPVs was highly enhanced compared with the conventional ones with an ITO anode.

3PS-144 정재용
A High Mobility Conjugated Polymer Based on Dithienothiophene and Diketopyrrolopyrrole for Organic Photovoltaics

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Recently, diketopyrrolo[3,4-c]pyrrole (DPP) has emerged as an important building block of active materials for organic electronics. Particularly semiconducting polymers based on DPP exhibited high hole mobilities up to $1.0 \text{ cm}^2 \cdot \text{V}^{-1} \cdot \text{s}^{-1}$ in OFETs and promising power conversion efficiencies (PCEs) of 4.5-5.5% in OPVs when DPP is copolymerized with electron-rich monomer such as thiophene. In this work we synthesized a novel conjugated polymer (PDTTDP) consisting of dithieno[3,2-b:2',3'-d]thiophene (DTT) and DPP. PDTTDP shows an extended light absorption up to 1020 nm with a low bandgap of 1.39 eV, and moderately low-lying highest occupied molecular orbital level of 5.19 eV. Due to the extended aromatic nature of DTT, PDTTDP exhibits high intermolecular π - π interaction with edge-on orientation on the substrate in film. The PDTTDP showed an outstanding hole mobility of $0.68 \text{ cm}^2 \cdot \text{V}^{-1} \cdot \text{s}^{-1}$ in OFETs and a promising PCE of 6.05% in OPV with PC₇₁BM without any post treatment.

3PS-145 조경천
Template-Assisted Fabrication of TiO₂ Nanotube Arrays by Si-Containing Block Copolymer Lithography and Atomic Layer Deposition: Properties and Potential in Photovoltaic Devices

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Highly ordered freestanding TiO₂ nanotube arrays with various wall thicknesses were fabricated by applying atomic layer deposition (ALD) to the nanoporous templates with high aspect ratios. The high thermal stability of the cross-linked organic template allowed high-temperature ALD. Easy removal of the organic template by a dry etch process followed by calcination produced vertically aligned and highly crystalline anatase TiO₂ nanotube arrays without collapse or bundling. Furthermore, the ultrafine thickness tunability of the ALD process made it possible to develop TiO₂ nanorods as well as nanotubes with different wall thicknesses. In addition the viability of TiO₂ nanotube arrays deposited on indium tin oxide glass electrodes for application in hybrid P3HT:TiO₂ solar cells is studied.

3PS-146 조동준
Organic Thin Film Transistor with New Organic Semiconducting Materials Having Benzotrithiophene Unit

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유기박막트랜지스터(OTF)는 저비용, 저온공정, 대면적화 등의 장점을 가지고 있어 차세대 유인전자소자 및 RFID(Radio-frequency identification) 등에 응용할 수 있으므로 많은 관심을 받고 있다. 최근 OTF 성능과 직결되는 유기반도체 재료의 특성을 개선하기 위한 연구가 활발히 진행되고 있으며, BTT(Benzotrithiophene) unit을 가지는 유기반도체 재료를 이용한 OTF에서 전기적 특성이 향상된 결과가 보고되었다. 본 실험에서는 BTT unit을 가지는 새로운 고분자 유기반도체 재료를 분광분석법과 열분석법 등을 이용하여 분자의 구조와 열적 특성 등 분석하고, OTF 소자를 제작하며 전기적 특성과의 연관성을 조사하였다.

3PS-147 조제용
Effect of Bridge Unit in Thieno[3,4-d]thiazole Based Conjugated Polymer for Photovoltaic Application

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In the last decade, alternating copolymers composed of electron-donating and electron-accepting units have been developed to achieve highly efficient polymer solar cells. In many cases, electron-donating and electron-accepting building blocks are linked with bridge units, such as thiophene, biphenylene, and thienothiophene, for the purpose to improve planarity of polymer backbone, to absorb photons by dual-band-absorption, and to enhance solubility of the copolymer (in this case, the use of alkylated bridge molecule). However, the effects of bridge unit on the energy level of polymer and the solar cell performance are not well-understood yet. In this study, we synthesized thieno[3,4-d]thiazole based alternating copolymers with several different bridge. As expected, the bridge molecule having less electron-donating ability leads to deeper HOMO energy levels of polymer and thus higher VOC of solar cell device.

3PS-148 조홍연
Sulfonation of Exfoliated Graphene Nanoplatelets for Hydrogen Storage

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Graphene is recently focused for next generation carbon material which has outstanding properties and 2-dimensional sheet form, but it requires techniques to make well-defined graphene sheets and commercially producible. Exfoliated graphene nanoplatelet(xGNP) can be an answer for this requirements. It is micro-scale graphene sheets which has