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A Slot-die coating process is one of the promising methods to fabricate large-area polymer solar cells (PSCs) due to its compatibility with R2R and direct patterned coating processes. The slot-die coating method has been usually used to fabricate high viscosity films such as polyimide and adhesion films in the industry. However, the coating principles and methodologies are not still established for low viscosity materials. In this study, we found a simple correlation between conformal film morphology and universal factors such as a coating speed, substrate temperature, and shim length. Based on our understanding of the basic correlations, we successfully demonstrated the large-area polymer solar cells (10mmX10mm) using poly(3-hexylthiophene)(P3HT) and fullerene derivative [6,6]-phenyl-C61-butyric acid methyl ester (PCBM), resulting in PCE of 2.5% under Air Mass 1.5 irradiation (100mW/cm²).

3PS-119 황동기

Application of polypyrrole nanofibers as a counter electrode for dye-sensitized solar cell

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The counter electrode (CE) in the dye-sensitized solar cells (DSSCs) plays a role in regenerating the oxidized sensitizer through the reduction of the redox species after electron injection. Due to the high conductivity and electro-chemical stability, conducting polymers have the potential to replace platinized counter electrodes in DSSCs. Among

them, polypyrrole (PPy) is of special interest because of its easy and fast synthesis, high conductivity, electrochemical reversibility and environmental stability. PPy nanofibers were fabricated by soft template polymerization method using NaSBA hydrate crystal in aqueous medium. The PPy nanofibers were coated onto fluorine-doped tin oxide (FTO) substrate to use as CE in DSSCs. The performance of the PPy-based DSSCs was characterized by cyclic voltammetry, current density-voltage measurements and electrochemical impedance spectroscopy.

3PS-120 황인태

Ion beam-based surface modification of a fluoropolymer for the formation of cell micropatterns

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In this study, a simple method for the formation of cell micropatterns on a fluoropolymer surface using ion implantation process was described. Fluoropolymer films were ion-implanted through a patterned mask at a high fluence to fabricate micropatterned superhydrophobic surface. The surface properties of the implanted films were investigated in terms of their wettability, chemical composition, and surface morphology. The results of the cell culture on the implanted films revealed that cells were adhered and proliferated onto the non-implanted regions, not on the superhydrophobic surfaces, resulting in the well-defined micropatterns of cells on the fluoropolymer surface.

분자전자 부문위원회 (III)

3PS-121 이보람

Highly Efficient Polymer Light-Emitting Diodes Using Graphene Oxide as a Hole Transport Layer

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3PS-122 이상범

New Nonlinear Optical Thiolated Nitrophenylhydrazone Crystals

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본 연구에서는 황 원자를 포함한 전자 주개(thiolated electron donor)를 포함한 새로운 4-nitrophenylhydrazone (NPH) 유도체를 합성하였다. 이 중 SB-NPH (4(phenylthio)benzaldehyde-4-nitrophenylhydrazone) 결정은 biphenyl sulfane (SB) 전자 주개가 헤링본 형태의 결정 구조를 이루고, NPH는 비대칭 비선형 광학 코어 구조로 작용하여, λ-형태의 결정 구조를 나타내었다. SB-NPH 결정에서 구성 분자들은 두 가지 이성질체를 가지며, 큰 거시적인 이차비선형성을 나타내었다.

3PS-123 이세현

Synthesis and characterization of water-soluble fullerene derivatives as interfacial materials for organic solar cells

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Interface engineering in organic solar cells is one of the strategies for high performance devices. Recently, fullerene derivatives for inverted organic solar cells have been studied due to their high electron mobility, tunable energy level and improvement of electrical contact. Especially, water-soluble fullerene derivatives as interfacial layer have some advantages: water solubility, well-matched energy level by induced interface dipoles and accomplishment of tandem cells. In this study, we synthesized water-soluble fullerene derivative having amine groups with high-yield amination reaction methods. The synthesized amino fullerene can be dissolved in polar solvent, preventing intermixing of the multilayers. The structural, optical, thermal and electronic properties of the fullerene derivative was characterized by ¹H-NMR, UV-vis spectroscopy, TGA/DSC and Kelvin probe measurement. Finally, the effects of using the interfacial layer in the organic solar cells will be discussed.

3PS-124 이승철

Water-dispersible Polyaniline Copolymers with Polar Side-chains

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폴리아닐린은 높은 전도성을 가지면서도 간편한 합성법과 화학적 안정성으로 인해 최근 각종 고분자 고분자이다. 폴리아닐린은 유기 발광 다이오드, 유기 박막 트랜지스터, 그리고 유기 태양 전지 등에 사용이 되는 유기전극을 포함한 많은 분야에서 응용 되어 질 수 있다. 본 연구에서는 극성 겔가지를 도입한 아닐린 유도체와 겔가지를 도입하지 않은 아닐린을 공중합하

여 폴리아닐린 공중합체를 중합하였고, 이를 통해 물뿐만 아니라 극성 유기용매에서 가공성과 분산성을 향상시켰다. 폴리아닐린 공중합체는 자기안정화 분산기법으로 중합시켰고, 이때 극성 겔가지를 가지는 아닐린 유도체는 물/비극성 유기용매를 이용한 중합반응에서 자기안정제 또는 계면활성제의 역할을 한다.

3PS-125 이승현

Styrylquinolinium Polymorphs with Highly Efficient Nonlinear Optical Properties

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본 연구에서는 다른 결정구조를 가지는 비선형 광학 HMQ-MBS (2-(4-hydroxy-3-methoxystyryl)-1-methylquinolinium 4-methoxybenzenesulfonate) 결정의 물성, 결정구조 및 광학적 성질을 조사 하였다. 다른 결정 구조를 가지는 단결정은 결정 성장 실험에 사용 하는 용매를 바꾸어 성장 시켰으며, 이를 HMQ-MBS(a), HMQ-MBS(b) 상으로 각각 명칭 하였다. 두 가지 상은 모두 acentric한 분자 배열을 가지며 단사정계를 이루고 있다. 각각의 공간군은 Pc와 Pn으로 다르며 두 결정 모두 높은 비선형 광학 효율을 나타낸다. 두 결정의 분자간 상호 작용은 비슷하며 페닐기의 수소결합 주개와 수신평의 수소결합 받개 사이의 강한 쿨롱 상호작용을 이룬다.

3PS-126 이정관

Enhancement of Photovoltaic performance in Dye-sensitized solar cells with the TiO₂ passivation layer

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The TiO₂ thin film layers were introduced with the spin-coating method between FTO electrode and TiO₂ photoanode in dye sensitized solar cell (DSSC) to prevent electron back migration from the FTO electrode to electrolyte. The DSSC containing different thickness of TiO₂ thin film (10~30, 40~60 and 120~150 nm) were prepared and photovoltaic performances were analysed with I-V curves and electrochemical impedance spectroscopy. The maximum cell performance was observed in DSSC with 10~30 nm of TiO₂ thin film thickness (11.92 mA/cm², 0.74 V, 64 %, and 5.62 %) to compare with that of pristine DSSC (11.09 mA/cm², 0.65 V, 62 %, and 4.43 %). The variation of photoelectric conversion efficiency of the DSSCs with different TiO₂ thin film thickness was discussed with the analysis of crystallographic and microstructural properties of TiO₂ thin films.

3PS-127 이준원

Synthesis and Photovoltaic Properties of Small Molecules Based on Triphenylamine and Diketopyrrolopyrrole for Organic Photovoltaic Cells

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Various types of small molecules for donor materials of organic photovoltaics have recently been developed due to their advantages over conjugated polymers such as stronger absorption coefficient, better thermal stability and easier synthesis. In this study, we synthesized three small molecules based on triphenylamine (TPA) and diketopyrrolopyrrole (DPP), TPA(DPP)1, TPA(DPP)2, and TPA(DPP)3, in which TPA and DPP are electron-rich unit and electron-deficient unit, respectively. DPP units are attached to the para-positions of phenyl groups in TPA to produce TPA(DPP)1, TPA(DPP)2, and TPA(DPP)3. Chemical structures and electrochemical properties of the three small molecules are measured by NMR, GC-mass, UV-vis absorption, and cyclic voltammetry. The solar cell performances of the cells with three different small molecules are measured and analyzed in terms of molecular symmetry.

3PS-128 이준영

Characterization of TIPS-pentacene/ZnO nanowire bilayer ambipolar transistor and its application

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We report on the organic-inorganic hybrid ambipolar field-effect transistor (FET) device