

## IPS-166 김만수

## Work Function Tunable Conducting Polymer Transparent Electrode and Its Application in OLED

권순, 김영철<sup>†</sup> 경희대학교

유기발광다이오드(OLEDs), 유기태양전지(OPVs)와 같은 유기전자소자에서는 전극의 투과도 유한전도도에 더불어 일함수가 소자의 특성을 결정짓는 중요한 요인으로 작용한다. 본 연구에서 전산화제 겸 도판트인 Iron(III)-p-toluenesulfonate(FTS)와 3,4-ethylenedioxythiophene(EDOT)이 함께 혼합된 중합용액을 Polyethylene naphthalate(PEN)기판 위에 코팅하고 *in-situ* 중합을 통하여 유연성 전도성고분자 투명전극(PEDOT:FTS)을 제조하였다. 중합과정에 큰 이온화 에너지를 갖는 perfluorinated ionomer(PFI)를 도입하여 PEDOT:FTS 필름의 일함수에 미치는 영향에 관하여 연구하였으며, 이렇게 제조된 PEDOT:FTS를 전극으로 사용하여 Flexible Organic Light-Emitting Diode (FOLED)를 제작하고 그 특성을 비교하였다.

## IPS-167 김병관

## Solid-State Polymerization of Active Monomers for Formation of Hole Transporting Meso-Channels Inside Mesopores

김병관, 김정훈, 김은경<sup>†</sup> 연세대학교

Solid-state polymerization (SSP) of active monomers was achieved inside nanostructure layers for formation of hole transporting meso-channels (HTCs). Thermally polymerizable monomers had highly crystalline structure and needed small activation energy for SSP with respect to reaction time calculated by Arrhenius equation. Also heat-active polymerizable monomers were deeply penetrated into mesoporous semiconductive oxide film. Through controlled crystallization and heat addition, solid-state polymerized conductive polymers showed well-packed structure inside mesoporous as HTCs. Highly conductive HTCs applied to solar cells to afford highly efficient solid-state film cells.

## IPS-168 김보람

Synthesis of Modified PCBM bisadduct Containing 4-Nitro- $\alpha$ -cyanostilbene moiety김보람, 김경식, 양창덕<sup>†</sup> 울산과학기술대학교

We report here optical and electrochemical properties of a modified fullerene derivative, bis-F. It has two large 4-nitro- $\alpha$ -cyanostilbene moiety instead of ester methyl groups of PCBM. This replacement aimed to increase the absorption, enhance the solubility. bis-F shows higher solubility in common organic solvents and stronger absorption than PCBM in the range of 250~900nm like F. The LUMO energy level of bis-F is -3.73eV.

## IPS-169 김상균

Nb-doped anatase TiO<sub>2</sub> nanoparticles with hole-conducting coadsorbents for highly efficient DSSCs

In order to improve the Voc and Jsc, we synthesized light Nb-doped anatase TiO<sub>2</sub> nanoparticles and employed in organic dye-sensitized solar cells with hole-conducting coadsorbents. Nb-doped TiO<sub>2</sub> is possible to increase the charge transport ability by the formation of intra-band state and the charge injection improvement thus increasing the Jsc. The hole-conducting coadsorbents have multiple functions, that is, the prevention effect of  $\pi$ - $\pi$  stacking of organic dye to enhance Voc by reducing the charge recombination, and the cascade-typed hole hopping channel to enhance Voc and Jsc.

## IPS-170 김성민

## Synthesis and characterization of phenazine derivatives based on electron donor polymers for organic photovoltaics

김성민, 김형필, 김지유, 배일지, 이명훈<sup>†</sup> 전북대학교; <sup>†</sup>경희대학교

$\pi$ -conjugated polymers are attractive due to their easy processing, large area application, light weight and flexible panels as well as potential contribution to renewable and clean energy. So, many researchers have reported various conjugation polymers to obtain high efficiency for organic photovoltaics. In this study, Donor-acceptor copolymers containing an electron donor fluorene chemically linked to electron acceptor phenazine derivatives were synthesized. These copolymers were characterized and employed in fabrication of OPVs.

## IPS-171 김슬기

## Synthesis and characterization of bulk-heterojunction solar cells based on donor-acceptor type small molecules

김슬기, 박상혁<sup>†</sup> 공주대학교

In order to develop high efficiency organic photovoltaic materials that exhibit promising electronic properties, electroactive small molecules have recently received attention as alternatives to polymers. A novel class of donor-acceptor type small molecules for electron donating active layers for bulk-heterojunction solar cells were synthesized and investigated. The thermal, optical and electronic properties of the molecules were examined by thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), UV-vis absorption, and cyclic voltammetry (CV). The synthesis, characterization and photovoltaic properties of low band gap small molecules will be discussed.

## IPS-172 김신성

## Improvement of Compatibility in P3HT/Inorganic Hybrid Solar Cells by P3HT Containing Amine Group

김신성, 이윤규, 조원호<sup>†</sup> 서울대학교

Conjugated polymer-inorganic semiconductor hybrid solar cells (HSCs) have received considerable interest as a promising approach to achieve the cost effective solar cell. HSCs have several important advantages over organic photovoltaics due to relatively high electron mobility, morphological stability and adjustable absorption properties of

nanstructured inorganic materials (CdSe nanoparticles). However, strong aggregation of the inorganic nanoparticles in polymer/inorganic blend prevents effective charge transport and consequently diminishes the solar cell efficiency. To solve this problem, we have functionalized poly (3-hexylthiophene) (P3HT) by amine group to improve the compatibility between P3HT and CdSe, and the effects of amine group in P3HT on the blend morphology and photovoltaic performance will be demonstrated.

## IPS-173 김연옥

## Synthesis and Photophysical Studies of Luminescent Lanthanide(III)-cored Complexes Based on Alkyne Substituted Diphenylquinoxaline Dendritic Derivatives

김연옥, 임유경, 김환규<sup>†</sup> 고려대학교 신소재화학과 & 태양광정보소재 연구센터

The novel lanthanide(III) complexes based on alkyne substituted diphenylquinoxaline dendritic ligand were designed and synthesized to enhance the luminescence intensity of Er<sup>3+</sup> ions for photonic applications and to provide enough coordination sites for the formation of stable Er(III)-chelated complexes. The alkyne substituted diphenylquinoxaline ligand was used as photon antenna for the efficient light harvesting effect by improving the low quantum yield and molar-extinction coefficient of the well-known aryl-ether dendron. These novel complexes are predicted to enhance the energy transfer efficiency more by a liner structure than by tilted structure. Er<sup>3+</sup>-cored supramolecular complex based on alkyne substituted diphenylquinoxaline ligand exhibited strong near-IR emission.

## IPS-174 김영윤

## Enhanced Efficiency of OLEDs by Localized Surface Plasmon Coupling of Ag Nanoparticles through Ligand-exchange Process on ITO Substrate

김영윤, 박금환, 현우진, 박오목<sup>†</sup> KAIST; <sup>†</sup>KAIST/DGIST

Organic light-emitting diodes (OLEDs) have studied over last few decades due to their many advantages for potential applications in displays, and lightings. One remarkable way to enhance the efficiency of OLEDs is to introduce localized surface plasmon resonance (LSPR) into OLEDs. Herein, we reports new and simple method to couple localized surface plasmons from Ag nanoparticles (NPs) with emissive materials. First of all, PVP-capped Ag NPs were successfully synthesized and analyzed by scanning electron microscope (SEM) and UV-Vis spectrophotometer. To attach the Ag NPs on the ITO substrate, 11-mercaptoundecanoic acid (11-MUA) was introduced on the ITO surface. Then Ag NPs capped with PVP was deposited by drop-casting on the ITO substrate. Ag NPs were attached on the ITO through ligand-exchange process on the surface. Properties of Ag NPs film was measured by various techniques. Finally, localized surface plasmon coupled OLED based on functionalized Ag NPs film was fabricated.

## IPS-175 김영훈

## Flexible, inverted polymer light-emitting diodes on flexible substrates

김영훈, 이태우<sup>†</sup>, 임경근 POSTECH

Although polymer light emitting diodes(PLEDs) have been actively investigated as a next display and solid-state lighting technologies, the realization of their flexible devices is limited by use of brittle indium tin oxide(ITO)/glass substrate and encapsulation glass. In order to solve these problems, we fabricated air-stable inverted PLEDs (IPLEDs) using smooth conductive substrate as a cathode and MoO<sub>3</sub>/Ag/MoO<sub>3</sub> multilayer as the transparent anode. The ZnO layer were thermally converted from spin-coated zinc acetate films at high temperature above 300°C. In this manner, we demonstrated high-efficiency air-stable flexible IPLEDs, which are potentially promising candidates for flexible large-area solid-state lighting devices produced by roll-to-roll mass process.

## IPS-176 김유진

## Properties of alternating copolymers based on naphtho[2,1-b:3,4-b']dithiophene (NDT) for solution-processed polymer solar cells

김유진, 차효정, 장재원, 김지예, 김래호, 박찬연<sup>†</sup> 포항공과대학교; <sup>†</sup>경상대학교

In this work, a newly designed naphtho[2,1-b:3,4-b'] dithiophene derivative which plays a role of electron donor unit has been prepared. Among electron-rich unit, NDT is an ideal conjugated unit for new photovoltaic material because of large planar structure for better  $\pi$ - $\pi$  stacking. We compared properties of the polymers based on NDT with strong electron donating moiety and strong electron withdrawing moiety in organic solar cells view. Also, we analyzed the film morphology of the bulk heterojunction mixtures with [6,6]-phenyl C71-butyric acid methyl ester (PCBM) by atomic force microscopy and transmission electron microscopy. We report the characterization and device performance of the polymers consisted of thiophene (T) moiety or benzothiadiazole (BT) moiety.

## IPS-177 김인철

Synthesis and characterization of well-dispersed Nb-doped TiO<sub>2</sub> nanoparticles for polymer solar cell application김인철, 이원목<sup>†</sup>, 김경관, 옥일우<sup>†</sup> 새중대학교; <sup>†</sup>KAIST

TiO<sub>2</sub>의 나노 입자 및 얇은 박막필름은 n-형 반도체, 광전소자, 광변색소자, 전기발광, 촉매, 화학센서, 태양전지 등 여러 분야에 적용되고 있다. 본 연구에서는 기존의 TiO<sub>2</sub>에 Nb가 도핑된 나노입자를 새로운 Sol-gel법으로 합성하여 유기태양전지의 전자수송층(ETL: Electron transport layer) 성능향상을 추구하였다. 합성한 Nb-doped TiO<sub>2</sub>를 XPS(X-ray photoelectron spectroscopy)로 나노 입자의 구성성분을 분석하였고 다양한 방법으로 나노 입자의 형태와 크기를 분석하였다. 그리고 Ellipsometry를 사용하여 굴절률을 측정하는 등 Nb-doped TiO<sub>2</sub> 박막의 성질을 밝히고자 하였다. 또한 Nb의 도핑 양이 조절될 때 Nb-doped TiO<sub>2</sub>의 결정구조 및 물리적 특성변화 그리고 이것이 ETL로 사용되었을 때 태양전지의 성능에 변화가 있는지 알아보았다.

## IPS-178 김정석

Novel Naphtho[1,2-b:5,6-b']dithiophene Cored Linear Donor- $\pi$ -Acceptor Con-