The stoichiometric investigation of chlorine ion inclusion in CHNHPbI3-xClx perovskite solar cell via PbI1-xClx layer

1PS-232 고용민

Covalent-bonding Layer-by-Layer Assembly of MWCNT/Iron Oxide nanoparticle Multilayers with High Electrochemical Performance and Stability

고용민, 조진한† 고려대학교

Hybrid supercapcitor electrodes based on (MWCNT/Iron oxide nanoparticle (NP))$_n$ multilayer thin film with high electrochemical performance and stability were prepared using a covalent-bonding layer-by-layer (LbL) assembly in organic media. It is originated from the high affinity between MWCNT and oleic acid-stabilzed Fe_3O_4 NP (OA-Fe_3O_4 NP). Covalent-bonded (MWCNT/Iron oxide NP)$_n$ multilayer electrodes were showed the extremely high film density of approximately 1.92 g · cm^{-3} due to dense packing of OA-Fe_3O_4 NPs onto conductive and porous MWCNT layer. The resulting multilayer electrodes were exhibited high volumetric capacitoance of ~ 248 ± 15 F · cm^{-3} (127 ± 7 F · g^{-1}) at a scan rate of 5 mV · s^{-1} in aqueous electrolyte despite the theoretically low specific capacity of the Fe_3O_4 NP. In addition, the performance of these multilayer electrodes were retained 99.2 % of their initial capacitance after 1000 cycles.

1PS-233 고종국

Nano-Confinement Effect on Conductive Polymers and Its Application to Organic Solar Cells

고종국, 송지연[1], 김태용, 윤현식[2], 이창희[1], Ruediger Berger[3], 차국헌† 서울대학교 화학생물공학부; [1]서울대학교 전기컴퓨터공학부; [2]서울과학기술대학교; [3]Max Planck Institute for Polymer Research

In the present study, we employed scalable nano-imprinting lithography as a method to change the molecular orientation by exploiting nano-confinement and also studied its application to organic solar cells. We fabricated nanorods of conductive polymers with different chemical structure, dimension, and crystallinity based on patterning with AAO templates. GIWAXS measurements showed different chain orientation and crystallinity different from bulk crystallinity. We adopted P3HT nanorods with face-on orientation for the ordered heterojunction organic solar cell architecture. We were able to control both chain orientation and domain size of organic solar cells with patterned nano-imprinted of P3HT nanorods coupled with thermal annealing to control the mutual diffusion between P3HT and PCBM. Finally, we optimized the morphology of ordered organic solar cells and obtained more than 5 times higher power conversion efficiency than bilayer organic solar cells.

1PS-234 공성영

The stoichiometric investigation of chlorine ion inclusion in $CH_3NH_3PbI_{3-x}Cl_x$ perovskite solar cell via $PbI_{1-x}Cl_x$ layer

공성영, 권태혁† 울산과학기술대학교

Perovskite solar cells based on methylammonium trihalide ($CH_3NH_3PbI_3$ and $CH_3NH_3PbI_{3-x}Cl_x$) have recently emerged as promising materials. Especially, the mixed halide perovskite absorber ($CH_3NH_3PbI_{3-x}Cl_x$) generally shows a long electron-hole diffusion length over 1μm while $CH_3NH_3PbI_3$ has a relatively short electron-hole diffusion length ~100 nm. So, the ratio of chlorine in perovskite solar cells is a very critical parameter, but there are few systematic researches on it. Here, to control the ratio of chlorine, we prepared the mixed halide perovskite solar cells employing new two-step solution process. Although this two-step process doesn't much change the ratio of chorine in perovskite absorber, we found that the slightly change of chlorine ratio obviously affected on the PCE. The quantitative composition, packing mode, and morphology of this mixed halide perovskite was confirmed by energy dispersive X-ray spectroscopy, X-ray diffraction, and scanning electron microscope, respectively.

1PS-235 곽 경

Preparation and Performance of Perovskite Solar Cells Based on Inorganic Nanoparticles

곽 경, 황보라, 조서연, 박선영, 권용구† 인하대학교 고분자공학과

In search of new materials suitable for the electron-transporting interlayers in perovskite solar cells, various inorganic nanoparticles were introduced. Nanoparticles of titania, barium titanate or their mixtures with average diameters of a few tens of nanometer were incorporated within the perovskite solar cells and their thickness in the range of a few hundreds of nanometer was used in this study. These nanoparticle layer increased the contact area with perovskite and improves the performance of the perovskite solar cells, and also played an additional role as a diffractive layer to provide an efficient way of achieving light trapping in perovskite solar cells.

1PS-236 구민정

Acentric quinolinium crystals with naphthalenesulfonate anion for nonlinear optical applications

구민정, 김필주, 권오필† 아주대학교

The quinolinium derivatives with naphthalenesulfonate anion are investigated about the effect of naphthalenesulfonate anion on acentric crystal packing with HMQ (2-(4-hydroxy-3-methoxystyryl)-1-methylquinolinium) cation. The developed quinolinium derivatives are HMQ-N1S (2-(4-hydroxy-3-methoxystyryl)-1-methylquinolinium naphthalene-1-sulfonate) and HMQ-N2S (2-(4-hydroxy-3-methoxystyryl)-1-methylquinolinium naphthalene-2-sulfonate). The main supramolecular interaction of two derivatives is similar to that in the crystals based on HMQ cation. In addition, both HMQ-N1S crystals and HMQ-N2S crystals have an acentric crystal packing with high order parameter and HMQ-N2S crystals exhibit a large macroscopic optical nonlinearity. Therefore, we demonstrate that the modification of naphthalenesulfonate anion with HMQ cation can be an efficient approach for nonlinear optical applications.

1PS-237 권구현

Enhanced Performance of Pseudo-Bilayer Organic Photovoltaic Devices via Small Molecule Doping

권구현, 김충익† 서강대학교

Controlling both film crystallinity of the active layer for better charge transport and the interdiffusion between donor and acceptor materials for optimal bicontinuous networks is essential in producing pseudo-bilayer polymer solar cells. In this work, we investigated the influence of a doping 5,11-bis (triethylsilylethynyl) anthradithiophene (TES-ADT), on the performance of pseudo-bilayer polymer solar cells made of an underlayer of poly(3- hexylthiophene)(P3HT) and an upper layer of [6,6]-phenyl-C61-butyric acid methyl ester (PCBM). Power conversion efficiency was enhanced by 8% while short-circuit current density was enhanced by 14%. Increased crystallinity and occurrence of interdiffusion between P3HT:TES-ADT and PCBM was confirmed by XRD, UV-vis absorbance spectra and SEM. A new method for improving the performance of pseudo-bilayer polymer solar cells has thus been successfully demonstrated.

1PS-238 권재혁

Diketopyrrolopyrrole based organic field effect devices: Investigation of various substrates and substrate temperatures on device efficiency

권재혁, 표승문†, 나한아, Akshaya K. Palai, Amit Kumar 건국대학교

Non-Functionalized soluble diketopyrrolopyrrole (DPP) core is used as the p-type semiconductor material in organic field effect transistor(OFET). We report the characteristic of various alkyl chains based soluble DPP derivatives and investigated their behaviors in OFET. The characteristics have been analysis by using UV-vis and X-ray diffraction, cyclic voltammetry (CV) and atomic force microscopy (AFM). Especially, DPP-R12 was investigated in detail. In top contact OFET, two type of gate insulator is prepared, cross-linked poly(4-vinylphenol) and OTS/SiO_2. The performance of devices and the surface characteristic according to three different temperatures (25 ℃, 60 ℃, and 90 ℃) is investigated. When substrate temperature was 90 ℃, OFETs fabricated on CL-PVP shows the maximum performance with hole mobility of 0.013 cm^{2}V^{-1}s^{-1}. In addition, stability characteristic was checked and the inverters using DPP-R12 were fabricated and their static and dynamic characteristics are analyzed.

1PS-239 김경훈

Fluorinated Polymer Brush Nanolayer for Advancing the Electrical Stability of Organic Field-Effect Transistors

김경훈, 백용화, 김세현[1], 박찬언† 포항공과대학교; [1]영남대학교

We chemically graft a fluorinated polymer brush nanolayer onto the polar oxide dielectric surfaces via a simple and easy fabrication process in ambient air. The para-fluorine-thiol click reaction between polypentafluorostyrene and mercaptopropyltrimethoxysilane is used to synthesize a fluorinated polymer brush (PFS-brush). A variety of semiconductor materials are employed for the OFETs prepared with PFS-brush-treated SiO_2 dielectrics, including vacuum-processed pentacene, N,N-ditridecyl-3,4,9,10-perylenetetracarboxylic diimide, solution-processed TES-ADT and DPP based polymer. The OFETs prepared using the PFS-brush-treated SiO_2 dielectrics display the highest mobilities and smallest hysteresis among the devices we studied. Furthermore, the PFS-brush-treated SiO_2 provide the best device stability under a sustained gate bias, suggesting that the PFS-brush surface minimize the number of traps present in the OFET.

1PS-240 김기태

Improve oxide semiconductor transistor performance through electrode-semiconductor interlayer

김기태, 김충익† 서강대학교

The electrical performance of metal oxide semiconductor based field-effect transistor (FET) improved by electrode-semiconductor charge injection layer with various n-type semiconductor. In comparison with the existing metal oxide FET with only aluminum electrode, the device performance has been considerably improved in gold, copper electrode device. This research expected more improve air stability, performance, and use low cost electrode in metal oxide semiconductor. We fabricated solution-process IGZO based field-effect transistor with top contact on SiO_2 substrate, and solution-precess interlayer.

1PS-241 김래호

Properties of Al_2O_3/TiO_2 mixed oxides for thin film encapsulation of organic light emitting diodes via plasma enhanced atomic layer deposition

김래호, 박선욱, 정용진, 안태규, 박찬언† 포항공과대학교

Organic light-emitting diodes require a passivation layer that protects the active layers from moisture and oxygen because most organic materials and electrodes are very sensitive to such gases. Passivation films for the encapsulation of organic electronic devices need excellent stability and mechanical properties. Alloys have been used as materials in ceramic and electronic fields due to their enhanced physico-chemical properties. Nano-laminate technique using plasma-enhanced atomic layer deposition (PEALD) is the one of the method to obtain alloy type thin film. We were fabricated OLED devices and then deposited stacks of Al_2O_3 and TiO_2 layer in angstrom scale for OLED encapsulation using PEALD process. The film properties including composition, water resistance, water vapor transmission rate, and surface morphology were investigated. In addition, electrical characteristics (I-V-L), EL spectra, and shelf lifetime of encapsulated OLED devices were evaluated.