on the role of the D/A nanostructuring on the OPVs performance and prospects for improvement. Acknowledgments: FCT-Portugal, under the contracts PTDC/CTM-NAN/111263/2009 and PTDC/CTM/101627/2008, for financial support. [1] J. Farinhas et al, J. Mater. Chem. 21, 12511 (2011).

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16:00 **Unmodified small-molecule organic light-emitting diodes and polymer solar cell by blade coating**

Authors : Hsin-Fei Meng

Affiliations : Institute of Physics National Chiao Tung University Hsinchu, Taiwan

Resume : Blade coating with substrate heating and hot wind is demonstrated to be a general platform for multi-layer deposition of unmodified small-molecule organic semiconductors with high fabrication throughput. Small molecules, originally designed for vacuum evaporation, can be blade coated as long as they have solubility above 0.5 wt%, which is satisfied for most molecules. High uniformity is achieved for scale over 5 cm. Orange devices by evaporation and blade coating are compared with NPB as the hole transport layer, CBP as the emissive layer host, an orange Ir complex as the emitter, and TPBI as the electron transport layer. The efficiency difference is within 20%. When 26DCzppy is used as the host, the current efficiencies are 40 cd/A (30 lm/W) for orange, 40 cd/A (25 lm/W) for green, and 25 cd/A (10 lm/W) for blue, and 35 cd/A (20 lm/W) for white. The optimized OLED structure developed for vacuum deposition can therefore be exactly copied by the low cost blade coating method in solution. In addition to OLED, blade coating is applied to single and multiple layer organic solar cell. 4.1% of power conversion efficiency is obtained for P3HT and PCBM in toluene solution without the conventional slow drying in dichlorobenzene. Using a low bandgap polymer by Prof. Zhikuan Chen the efficiency of 6.5% is achieved by blade coating. 4 13

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16:00 **Multiple excitons generation effect in hybrid solar cell: roles of phonons, surface and the efficiency of solar energy transformation**

Authors : Oksengendler B.L., Turaeva N.N., Marasulov M., Rashidova S.S.

Affiliations : Institute of Polymer Chemistry and Physics

Resume : The effect of multiple exciton generation (MEG) in quantum dots is one of the principal ways of increasing the efficiency of hybrid solar cells [1]. In our previous work [2] we proposed the statistical theory of simultaneous generation of excitons taking into account the conservation laws of energy and momentum and noted that this approach gave the ultimate quantum efficiency of excitons. In this work we have developed the statistical approach to MEG effect analyzing the process of simultaneous generation of two kinds of particles: fermions (electrons and holes) and bosons (phonons). It has been calculated the probability of generation of two excitons and one phonon, differing two types of electronic transition (direct and non-direct). The role of surface electronic states in the MEG effect has been taken into account on the base of earlier developed synergetics approach [3] to the description of non-Poissonian fluctuations of excitons. With the help of microscopic electronic "shaking" theory of MEG effect [4] and the presented statistical approach it has been calculated the efficiency of solar energy transformation into electrical one in quantum dots. 1. Nozik, A.J., Chem. Phys. Letters, Frontiers in Chemistry, 457, 3 – 11 (2008) 2. B. Oksengendler, N. Turaeva, S. Rashidova: Appl. Solar Energy, 3, 36 (2009) 3. N.N. Turaeva, B.L. Oksengendler and I. Uralov, Appl. Phys. Lett. 98, 243103 (2011). 4. N.N. Turaeva, B. L. Oksengendler, S.S. Rashidova, in proceedings of International Workshop "Low dimensional nanoscaled systems" ed. by K. Nakamura, Kh. Rakhimov, Tashkent 2011. 4 14

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16:00 **Improving the Stability of Organic Photovoltaics by Self-AssembledMonolayer to Prevent the Indium Diffusion into the Active Layer**

Authors : Ming-Chung Chen, Yi-Shiang Chiou, Abebe Tedla, and Yian Tai*

Affiliations : Department of Chemical Engineering, National Taiwan University of Science and Technology, Taiwan

Resume : This study describes the improvement of the stability of an organic photovoltaic (OPVs) incorporating copper phthalocyanine (CuPc) and fullerene (C60) as active materials, by inserting the aromatic self-assembled monolayers (SAMs) with carboxylic acid (-COOH) as anchoring groups between the indium-tin oxide (ITO) electrode and (3,4-ethylenedioxy-thiophene)–poly(styrenesulfonate) (PEDOT:PSS). The lifetime of the SAM-modified devices can be improved up to 200% as compared to the pristine 4 15

Resume : The characteristics of selective silver ion sensors are developed by extended-gate field-effect transistor (EGFET) are reported. Generally, the devices of extended-gate field-effect transistor are consisted of sensing membrane connected to field-effect transistor. In this study, poly(3-hexylthiophene) (P3HT) with different concentrations deposited on indium tin oxide (ITO) by spin coating and connected to gate of commercial MOSFET (CD4007 UB), which was used as a selective member as well as extended-gate electrode. The P3HT blended with 1,2-dichlorobenzene (DCB) to obtain various concentrations of P3HT solution range, 30 mg/ml to 50 mg/ml. The effects of various P3HT concentrations on the characteristics of selective silver ion sensor are investigated, such as thickness, crystallization, and morphology of P3HT. In comparison with various concentrations of P3HT, the 50 mg/ml P3HT exhibit an excellent sensitivity of 47.0 mV/decade and a linearity of 0.969 in the silver ion range of 10-1 to 10-4 M. Moreover, the selectivity of P3HT thin film is investigated by measuring the interfering effect of potassium ion in silver ion solution. The results show that potassium ion weakly interfere with the selective silver ion. As above of all results, sensitivity, selectivity, and range of detection are improved significantly by P3HT thin film. Because, the sulfur atoms and double bonds in chemical structure of P3HT, are interacted with silver ion, and make the interfering effect of K+ ion decreased. This work was supported by the National Science Council, R.O.C. under contract numbers of NSC 100-2221-E-006-039-MY3 and NSC 100-2221-E-006-041-MY3.

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16:00 **Using Self-Assemble-Monolayer on Nanopore Sidewalls to Enhance Vertical Hole Mobility of Regioregular Polythiophene in Vertical Polymer Transistors**

Authors : Hsiao-Wen Zan1, Yuan-Hsuan Hsu2, Hsin-Fei Meng2, Chian-Hao Huang1, Yu-Tai Tao3 and Wu-Wei Tsai1

Affiliations : 1 Department of Photonics and Institute of Electro-Optical Engineering, National Chiao Tung-University, 1001, Ta-Hsueh Rd, HsinChu, 300, Taiwan 2 Institute of Physics, National Chiao Tung University, 1001, Ta-Hsueh Rd, HsinChu, 300, Taiwan 3 Institute of Chemistry, Academia Sinica, Taipei, Taiwan 115, Taiwan

Resume : Charge transport in conjugated polymers such as regioregular poly(3-hexylthiophene) (P3HT) is anisotropic. Controlling chain orientation and improving molecule ordering are important if we want to obtain high carrier mobility in the desired current flow direction. For OFETs, channel current flows in lateral direction, in-plane pi-stacking with an edge-on orientation is desired. Treating the gate insulator by self-assembled monolayers (SAMs) enhances the edge-on orientation in P3HT. For OPVs and organic vertical transistors, face-on or vertical orientations are preferred. Confining conjugated polymers in vertically oriented nanopores helps to align the polymer chains in vertical orientation. Treating SAM on the sidewalls may further enhance the vertical chain alignment. In this work, we present the first experimental evidence that SAM-treatment on sidewall of nanopores plays an important role to improve the vertical hole mobility in P3HT. Significantly improved chain ordering and pore filling are observed when treating the nanopore sidewalls with SAMs, particularly with octadecyltrichlorosilane (OTS). Using blade coating to deposit P3HT further improves the chain ordering because the centrifugal force in the spinning process is eliminated. Finally, the SAM-treated vertical P3HT transistor delivers an output current as 50-110 mA/cm2 (50 times larger than control) at 2 V with an on/off current ratio larger than 10,000.

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16:00 **Nanostructuring photo-acid cross-linkable polymers for photovoltaics**

Authors : G. Brotas1, J. Farinhas1, Q. Ferreira1, A. Charas1 and J. Morgado1,2

Affiliations : 1Instituto de Telecomunicações, Avenida Rovisco Pais, P-1049-001 Lisboa, Portugal 2Department of Bioengineering, Instituto Superior Técnico, Technical University of Lisbon, Avenida Rovisco Pais, P-1049-001 Lisboa, Portugal

Resume : The remarkable progress achieved in the last years in the field of the organic photovoltaics has resulted from a combined development of materials and device engineering. Photoinduced charge separation and transport are two key processes determining OPVs efficiency and which largely depend on the details of the phase separation between electron-donor (D) and electron-acceptor (A). We have been investigating photoacid cross-linkable polymers to fabricate OPVs with nanostructured D/A interfaces, based on a patterning process using an assisting polymer [1] . In this communication, we present an overview of the materials we have so far prepared, their characterisation and their use in OPVs. We will mainly focus

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