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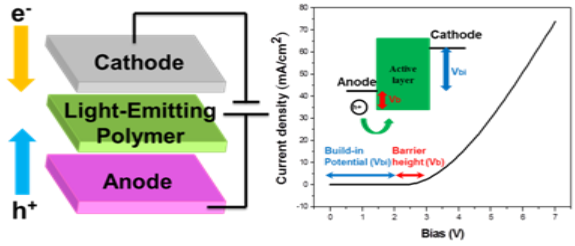
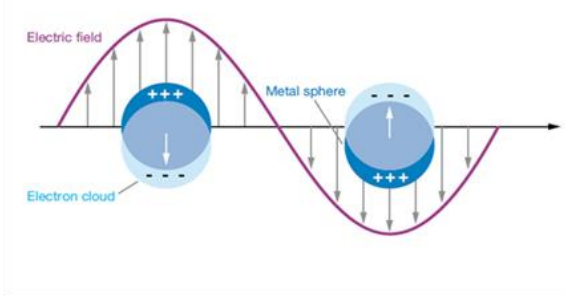
Research Interests

We are interested in studies of the interface in which electrons run through.

1. Electrons run through the interface when the redox reactions occur. Our studies involve elctrocatalysts, dimensionally stable anode, the solid electrolyte interface of lithium battery, conducting polymers, nano-composite for electrochemical sensor, etc.
2. Electrons run through the interface without reactions. We focus on polymer optoelectronics, such as, polymer light-eimtting diodes, photovoltaic cells, magneto study for interface injection, spin valve, multifuctional devices, etc.



3. Electrons fluctuate at the surface of nanometer-sized metals when they are induced by electromagnetic radiation. This phenomenon has great potential in sensing area, such as, molecular sensing, molecular imaging, etc.



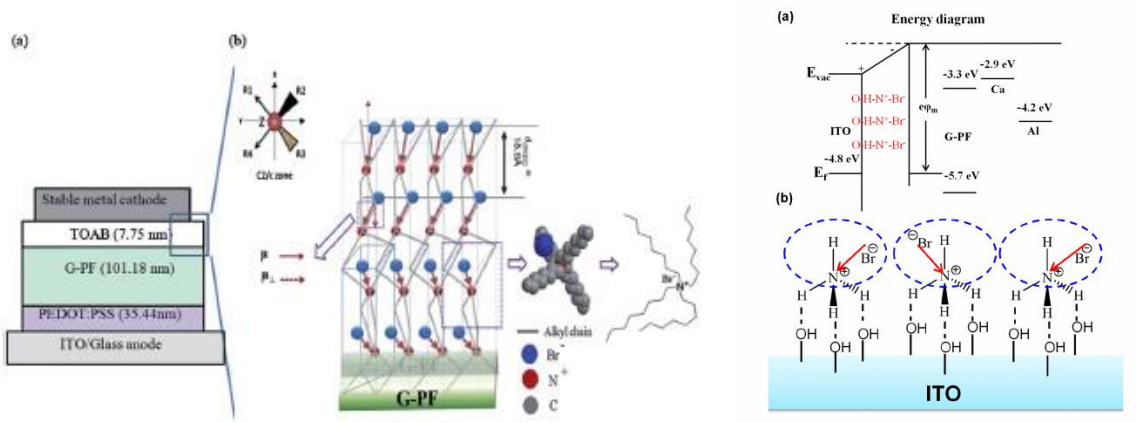
Representative Publications

1. Chen-Hao Wu, Chih-Yun Chin, Tsan-Yao Chen, Sung-Nien Hsieh, Chih-Hao Lee, Tzung-Fang Guo, Alex K.-Y. Jen and Ten-Chin Wen*, Enhanced performance of polymer solar cells using solution-processed tetra-n-alkyl ammonium bromides as electron extraction layers. Journal of Materials Chemistry A 1 (2013) 2582-2587.
2. Kai-Wei Tsai, Sung-Nien Hsieh, Tzung-Fang Guo, Yao-Jane Hsu, Alex K.-Y. Jen and Ten-Chin Wen*, Enhancing the hole injection ability of indium tin oxide via ammonium salts in polymer light-emitting diodes. Journal of Materials Chemistry C, 1, 531–535.
3. S. N. Hsieh, S. W. Hsiao, T. Y. Chen, C. Y. Li, C. H. Lee, T. F. Guo, Y. J. Hsu, T. L. Lin, Y. Wei and T. C. Wen*, "Self-assembled tetraoctylammonium bromide as an electron-injection layer for cathode-independent high-efficiency polymer light-emitting diodes", Journal of Materials Chemistry 21 (2011) 8715–8720 IF:5.968
4. C. Y. Li, Y. N. Chou, J. R. Syu, S. N. Hsieh, T. D. Tsai, C. H. Wu, T. F. Guo, W. C. Hsu, Y. J. Hsu and T. C. Wen, "Effect of annealing ZnO on the performance of inverted polymer light-emitting diodes based on SAM/ZnO as an electron injection layer", Organic Electronics 12 (2011) 1477–1482 IF:4.047
5. S. N. Hsieh, S. P. Chen, C. Y. Li, T. C. Wen, T. F. Guo and Y. J. Hsu, "Surface modification of TiO2 by a self-assembly monolayer in inverted-type polymer light-emitting devices", Organic Electronics 10 (2009) 1626–1631 IF:4.047

Research Topics

1. Interfacial engineering for organic optoelectronics

Organic/polymer light-emitting diodes (O/PLEDs) have attracted considerable attention due to their potential applications in flat panel displays and flexible displays. The self-assembled molecules of tetraoctylammonium bromide (TOAB) create an anisotropic dipole on hydrophobic surfaces, enhancing electron injection from cathode. The work function of the ITO is increased via H-bond formation between NH_4^+ and the O atom of the ITO to enhance hole injection from anode.



Scheme 1. (Left) Interfacial dipole formation via spin-coating TOAB atop luminescence layer. (Right) Increase in the surface work function of ITO by NH_4Br.

2. Robust and highly sensitive substrates for surface enhanced Raman spectroscopy

Surface enhanced Raman spectroscopy (SERS) is generally used to detect the molecular structures. Noble metal nanoparticles such as silver nanoparticles are referred to as hot spots. The assembling method offers great simplicity for the formation of hot spots on a large scale for reproducible Raman signal enhancement.

Fig. 1. Silver nanocubes synthesized with the polyol process. (Left) High magnification TEM images, (Right) SEM images of close packed silver nanocubes.

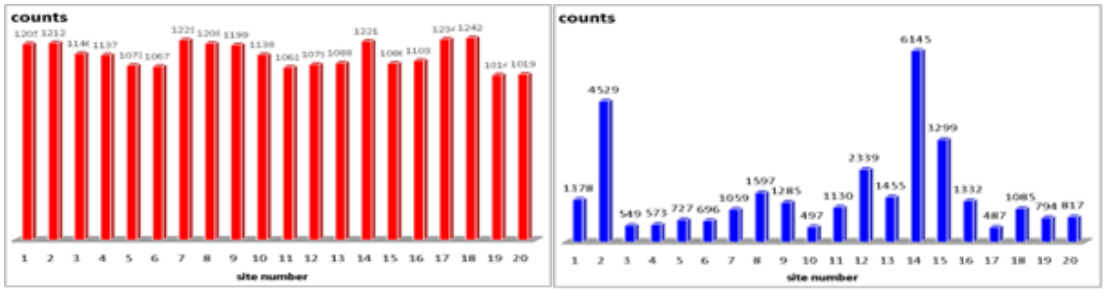


Fig. 2. The bar chart of SERS intensity from (Left) the substrates prepared by assembling method, (Right) the substrates prepared without assembling method.