

Recent advances in the synthesis and applications of conjugated materials for sensing, catalytic and energy applications

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The first part of my talk will focus on the development of functional nanocomposites with metal nanoparticles (MNPs) immobilized on conducting polymer (CP) surfaces. Despite recent advances in fabricating MNPs, it is extremely desirable to have a universal synthetic platform, which allows delicate control over the size, morphology and structure of MNPs, so that application potentials of such nanocomposites can be fully realized. Our synthetic platform is capable of tuning nanostructured metals in terms of their sizes, structures and morphologies. Due to synergetic properties pertaining to CP and MNP, our nanocomposites exhibit unique catalytic and plasmonic properties that are superior than commercial modules.

Despite recent progress in improving power conversion efficiency, the most critical issue in improving the PCE remains the structure and properties of the donor-acceptor (D- A) interface which dominates how electron transport from one side to the other. Modulation of interfacial structure and properties is considered one of the most critical issues in achieving OPV with high PCE. In our lab, we have been developing synthesis and characterization of conjugated oligomers with slight variation in the functional end group that will render tunable electronic structure and optical properties. We will present results in which we adopt these self-assemblies as interfacial layer to modulate OPV devices. Incorporation of oligothiophene interfacial layer results in a significant increase in the PCE, surpassing any other interfacial materials.

Professional Experience

Hsing-Lin Wang received his BS from Chemistry Department, National Chung Hsing University in 1984, Ph.D. in Chemistry from University of South Florida in 1992. He then became a Postdoctoral Fellow at University of Pennsylvania from 1993-1995. He came to Los Alamos National Laboratory as a Postdoctoral Fellow at 1995 and became a scientist in 1998. He has since then promoted to senior scientist, project leader and team leader. Hsing-Lin Wang's research activities involve 1) organic synthesis, processing and applications of functional polymers, fullerenes derivatives, and nanostructured materials, 2) Synthesis of metal oxide and graphene based nanocomposites for energy storage applications, 3) Preparation of nanostructured metals for chemical sensing (SERS) and catalytic reaction through spontaneous self-assembly, 4) Synthesis and characterization of biomimetic charge transfer complex 5) Synthesis of 2D materials e.g. perovskite and novel conjugated polymers for solar cell devices with very high conversion efficiency (~ 18 %). He has authored 2 book chapters, 170 peer-reviewed publications, 20 issued patents and 4 patents pending. He is the editor of two specific issues in "Polymers" and "Journal of Nanomaterials". His work has received more than 5400 citations with H-index of 37. He is the editors of five materials journals and received awards listed below.

Honor and Award

1998 Los Alamos Achievement Award

2000 NASA Cross Enterprise Technology Development Program Award

2001 R&D 100 awards

2001 Los Alamos Achievement Award

2002 Who's Who International Edition

2003 Employment Recognition Award, Sandia National Laboratory

2006 Distinguished Lecture Series, University of Washington

2010 Top10 Science and Technology Development, Los Alamos National Lab.

2012 Los Alamos National Lab. Top five R&D 100 awards finalists

2012 Distinguished Performance Award (Small Team, Team Leader).