School Seminar (2016-22)

School of Materials Science & Engineering

"Device Engineering in Organic and Perovskite Solar Cells: Interface Modification, Morphology Control, and Device Architecture Design"

Prof. Hongzheng Chen

(Dept. of Polymer Science & Engineering, Zhejiang Univ. China)

2016. 07. 15. (Fri.) 14:00

APRI 1F, Auditorium Hall

※ If you attend this lecture. it will be counted as 'Seminar of SMSE for 2016 Fall Semester' attendance.

Device Engineering in Organic and Perovskite Solar Cells: Interface Modification, Morphology Control, and Device Architecture Design

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Organic photovoltaic (OPV) devices could convert the solar irradiation into electrical power with the advantages of low cost, flexibility, light-weight, etc. This fantastic technique drew much attention due to the recent surge in device performance. These improvements are mainly attributed to the development of new materials and moreover, device engineerings including morphology control, interfacial engineering, and device architecture design. In this presentation, I will talk about the design and the fabrication of highly efficient polymer and hybrid solar cells by enhancing light absorption, improving charge carrier mobility, interface engineering and so on. By inserting a self-assembling monolayer between the ZnO and the perovskite active layers, controlling the perovskite crystallization kinetics by choosing proper precursors, designing the multi-functional novel hole transport materials, high power conversion efficiency up to 18.6% was delivered for organic-inorganic hybrid perovskite solar cells. The highly efficient large area organic solar cells with the best efficiency over 7% on a 4 cm^2 flexible sheet have also been demonstrated by carefully designing the transparent electrode.

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EDUCATION

Zhejiang University, China	Ph.D	Polymer Chemistry	1994
Zhejiang University, China	BS	Chemistry	1988

PROFESSIONAL ACTIVITIES

- Professor, Department of Polymer Science & Engineering, Zhejiang University, China, December 1999 to Present
- Associated Professor, Department of Polymer Science & Engineering, Zhejiang University, China, December 1996 to December 1999
- Lecture, Department of Polymer Science & Engineering, Zhejiang University, China, September 1994 to December 1996
- Visiting Scholar, Chemistry Department of University of Antwerpen (UIA) and IMEC (Interuniversity MicroElectronic Center), Leuven, Belgium, November 1999 to April 2001
- Visiting Professor, Stanford University, USA, Feb 2005 to August 2005

AWARD AND HONORS

- Chinese Young Chemistry Award (2000)
- NSFC Distinguished Young Scholars Grant (2002)

MAIN SCIENTIFIC PUBLICATION

- C. Huang, W. Fu, C.-Z. Li*, Z. Zhang, W. Qiu, M. Shi, P. Heremans, A. K.-Y. Jen*, and H. Chen*, A Dopant-Free Hole-Transporting Material with a C3h Symmetrical Truxene Core for Highly Efficient Perovskite Solar Cells, *J. Am. Chem. Soc.*, 2016, 138, 2528−2531

- S. Li, W. Liu, M. Shi*, J. Mai, T.-K. Lau, J. Wan, X. Lu, C.-Z. Li*, and H. Chen *, A spirobifluorene and diketopyrrolopyrrole moieties based non-fullerene acceptor for efficient and thermally stable polymer solar cells with high open-circuit voltage, *Energy & Environmental Science,* 2016, **9**, 604-610

- L. Zuo , Z. Gu , T. Ye , W. Fu , G. Wu , H. Li ,* and H. Chen*, Enhanced Photovoltaic Performance of CH3NH3PbI3 Perovskite Solar Cells through Interfacial Engineering Using Self-Assembling Monolayer, *J. Am. Chem. Soc.* 2015, 137, 2674-2679

- L. Zuo, S. Zhang, H. Li, H. Chen*, Towards Highly efficient large area ITO-free organic solar cells with conductance gradient transparent electrode, *Adv. Mater.*, 2015, 27, 6983–6989

- H. Li*, C. Fan, W. Fu, H. Xin, H. Chen*, Solution-grown organic single-crystalline donor-acceptor heterojunctions for photovoltaics, *Angew. Chem. Int. Ed.* 2015, 54, 956-960

- L. Zuo, C.-Y. Chang, C.-C. Chueh, S. Zhang, H. Li, A. K.-Y. Jen,* and H. Chen*, Design of a Versatile Interconnecting Layer for Highly Efficient Series-Connected Polymer Tandem Solar Cells, *Energy & Environmental Science*, 2015, 8, 1712-1718

- L. Zuo, C.-C. Chueh, Y.-X. Xu, K.-S. Chen, Y. Zang, C.-Z. Li, H. Chen* and A. K.-Y. Jen*, Microcavity-driven Enhanced Light-trapping for Highly Efficient Organic Parallel Tandem Solar Cells, *Adv. Mater.* 2014, 26, 6778–6784

- L. Wang, W. Fu, Z. Gu, C. Fan, X. Yang, H. Li*, H. Chen*, Low Temperature Solution Processed Planar Heterojunction Perovskite Solar Cells with CdSe Nanocrystal as Electron Transport/Extraction Layer, *J. Mater. Chem. C*, 2014, 2, 9087-9090

- W. Fu, L. Wang, Y. Zhang, R. Ma, L. Zuo, J. Mai, T.-K. Lau, S. Du, X. Lu, M. Shi, H. Li,* H. Chen*, Improving Polymer/Nanocrystal Hybrid Solar Cell Performance via Tuning Ligand Orientation at CdSe Quantum Dot Surface, *ACS Applied Materials & Interfaces* 2014, 6, 19154-19160

- C. Fan, A. P. Zoombelt, H. Jiang, W. Fu, J. Wu, W.Yuan, Y. Wang, H. Li*, H. Chen*, Z. Bao, Solution-grown organic single-crystalline p-n junction with ambipolar charge transport, *Adv. Mater.*, 2013, 25, 5762-5766

RESEARCH INTERESTS

- Organic photovoltaic materials and solar cells, organic-inorganic hybrid ma terials and solar cells

- Organic and hybrid semiconductors