

# **New Approaches to Enhance the Light Trapping and Carrier Extraction of Organic Photovoltaic Devices**

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A theoretical and experimental study of plasmonic organic solar cells with the metallic nanostructures is presented in this talk. From theoretical study, the physics of the performance enhancement of the organic solar cell is explained by multiphysics model of plasmonic organic solar cells. Meanwhile, we have also experimental investigated the plasmo-optical and plasmo-electrical effects with various metallic nanostructures such as metallic nanoparticles and metallic nanogratings into different regions of the solar cells. We will also introduce novel low-temperature solution-based approaches to fabricate novel carrier transport layers and electrode for the emerging technologies of low-cost and large area photovoltaics. Besides organic solar cells, the carrier transport layer can be applied to other devices such as organic LEDs and dye sensitized solar cells to improve their performances.

Our results show that the power conversion efficiency of organic solar cells can be enhanced by over 30% and the value of power conversion efficiency can reach about 9.2% depending on the metallic nanostructures, device structures, and the polymer materials. Details of the improvement will be discussed.

## Biography of Wallace C. H. Choy

Wallace C. H. Choy received his PhD Degree in Electronic Engineering from the University of Surrey, UK in 1999. His work at Surrey was supported by the Croucher Foundation Scholarship. He then joined National Research Council of Canada as a member of research staff to work on optical device structures of polarization independent optical amplifiers and modulators. He joined Fujitsu at San Jose, US in 2001 to develop real-time wavelength tunable lasers and optical transmitter modules. He is now an associate professor of Department of Electrical and Electronic Engineering, the University of Hong Kong (HKU). His current research interests are concerned with organic optoelectronic devices, plasmonic structures and nano-material devices, and optical and electrical properties of organics, metal nanomaterials and metal oxides. Dr. Choy has published 120 internationally peer-reviewed journal papers, one book (by Springer London), contributed to five book chapters, US and China patents (Details: <http://scholar.google.com.hk/citations?user=GEJf9dAAAAAJ>). He was the recipient of the Sir Edward Youde Memorial Fellowship, the Croucher Foundation Fellowship, HKU merit awards for research projects, HKU Research Output Prize and the Outstanding Achievement Award from National Research Council of Canada. He received overseas visiting fellowships from HKU to visit Prof. Y. Yang, UCLA (2009 and 2011 summers), Prof. Karl Leo, Institut fuer Angewandte Photophysik (IAPP), Technische Universitaet Dresden, Germany (2010 summer) and Prof. Junji Kido in Yamagata University, Japan (2012 summer) and Prof. Richard Friend, University of Cambridge (2013 summer) for studying organic LEDs and solar cells. He has delivered a number of invited talks and served as a committee member in internationally conferences organized by IEEE, OSA Plastic Electronics Foundation, etc. He serves as an associate editor of IEEE Photonics Journals and editorial board member of International Journal of Optics. He is a senior member of IEEE.



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