

19.12.2017 11:00

Room 3.71

Martensstraße 7, 91058 Erlangen

Interface Design and Optical Management for Polymer and Perovskite Solar Cells

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Abstract:

Interface engineering and optical management are powerful tools to enhance the performance of solar cells by improving the charge extraction and light harvesting properties of the devices. In this talk, I will discuss how to combine these two key strategies to improve performance of polymer (PSCs) and perovskite solar cells (PeSCs). In the first part of my talk I will discuss how to design new conjugated polymer-based interfacial materials with desired electrical conductivity, energy levels and processibility to improve the charge collection efficiency for PSCs based on fullerene¹ and non-fullerene acceptors.² The application of high throughput optical calculation was used to design the best device structures for highly efficient semitransparent³ and tandem PSCs with record high performance.^{4,5} In the second part, I will discuss how to lean on the experience in interface engineering for PSCs and design desired new electron⁶ and hole transport conjugated materials⁷ with proper interfacial properties to improve the charge collection efficiency of p-i-n heterojunction PeSCs. I will further discuss how to simultaneously modify both the anode and cathode interfaces to achieve devices with very large open circuit voltage (V_{oc}) and fill factor (FF), which is particularly important to realize high performance semitransparent PeSCs for power generating window applications.⁸ Finally, if I have time, I will also discuss the potential of using perovskite semiconductors for light emitting applications⁹ and the relationship between recombination dynamics and device performance for perovskite LEDs.

References

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Hin-Lap (Angus) Yip is a Professor in the State Key Laboratory of Luminescent Materials and Devices and the Materials Science and Engineering (MSE) Department in South China University of Technology (SCUT). He studied MSE at the Chinese University of Hong Kong (BSc 2001 and MSc 2003) and completed his PhD degree in MSE in 2008 under the guidance of Prof. Alex Jen at the University of Washington, Seattle. He then worked as a postdoctoral researcher at the same group before joining SCUT through the “Young Thousand Talents” program in 2013. His current research focuses on the use of an integrated approach combining materials, interface, and device engineering to improve both polymer and perovskite optoelectronic devices. He had published more than 130 scientific papers with citations over 13000 and H-index of 62.

He was also honored as “Highly Cited Researcher” in Materials Science by Thomson Reuters from 2014-2017.