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IAPME Seminar

Design and synthesis of functional molecular materials and their application in high-efficiency perovskite solar cells

24 January 2025

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Venue: N23-3022
Time: 10:00 - 11:00
Hosted by: Prof. Shi CHEN

Abstract

Commercialized perovskite solar cells not only need to have high PCE, but also need to have long time stability, low cost, and can be prepared by green and scalable processes. Rational composition design and interface modulation are the effective approaches to achieve these goals, and I will present several recent works of our research group in these aspects. Through introducing GABr into the perovskite material to suppress the oxidation of Sn2+ ions, we have prepared the ideal-bandgap Sn/Pb (1.35eV) perovskite solar cells with PCE of 20.6% and Voc loss of 0.33V, which is the lowest Voc loss reported so far. Then we combined the ideal-bandgap perovskite layer with DTBTI organic absorb layer, we prepared the integrated ideal-bandgap perovskite/bulk-heterojunction solar cell with PCE of 24.3%, which is the record efficiency for bulk-heterojunction solar cells. We also developed the CTAC/IPA based green anti-solvent method and prepared the solar cells with PCE of 23.4% and with excellent environmental, light, and thermal stabilities. Further, we added perovskite micro-crystals into the precursor solution to induce and control the crystallization process, we can obtain perovskite solar cells with PCE of 23.06% without using any anti-solvents. In addition, we doped p-type semiconducting material Cu(Tu)Cl into perovskite to modify its energy band, we got solar cells with PCE of 22% without using hole transport layer, which greatly simplified the device structure and thus lower down the cost. Finally, through using an SAM material to effectively modify the interface between perovskite and HTL, we obtained the solar cells with the best PCE of 26.5% and the certified PCE of 26%.

Biography

Prof. Xingzhu Wang works at the University of South China as a Chair Professor and obtained his Ph.D. degree from the Hong Kong Baptist University in 2009. After postdoctoral work at the University of Cambridge and Nanyang Technological University, he joined the National University of Singapore from 2013 to 2017 as a senior research fellow. He joined SUSTech in 2018 as an Associate Professor and was promoted to Full Professor in 2020. His current research interests relate to organic-inorganic synthesis, organic-inorganic semiconductors, and optoelectronic devices. He obtained 30 financial projects and had published 170 SCI scientific papers in high-quality and high-impact international journals including Science., Nat. Mater., Joule, J. Am. Chem. Soc., Angew. Chem., Adv. Mater., Adv. Energy Mater., Adv. Funct. Mater. The published papers had been cited by more than 5,000 times. He has 30 authorized patents. He has won more than 6 national and provincial science and technology awards.