



8th ICGC 2018 Session:

Porphyrins for New Generation of Solar Cells

Chen-Yu Yeh,^{a*} Hsien-Hsin Chou,^a S. Tingare Yogesh,^a Yu-Hsien Chiang,^b Peter Chen,^b

Nguyen So'n Vinh,^c Yu-Chieh Liu,^c Tzu-Chien Wei^c

^aDepartment of Chemistry, National Chung Hsing University, Taichung 402, Taiwan

^bDepartment of Photonics, National Cheng Kung University, Tainan 701, Taiwan

^cDepartment of Chemical Engineering National Tsing Hua University, Hsinchu 300, Taiwan

*e-mail: cyeh@dragon.nchu.edu.tw

Abstract:

Porphyrin dyes with a push-pull framework have been prepared and used in dye-sensitized solar cells, their spectral, electrochemical and photovoltaic properties were investigated. The photovoltaic measurements show that our push-pull porphyrins achieve high power conversion efficiency 10-13% under standard AM 1.5 sunlight.¹ For practical use of dye-sensitized solar cells at indoor conditions, a judiciously tailored organic dye achieves a milestone by displaying an efficiency of 28.56% when tested under T5 fluorescent illumination of 6000 lux.² We also synthesized porphyrin dimers for organic photovoltaics. Compared to the single porphyrin, the porphyrin dimers exhibited a large improvement on the power conversion efficiency. In addition, porphyrins have been synthesized for application in perovskite solar cells as efficient hole-transporting materials.³ A high efficiency of 16.60% is achieved by n-butyl tethered single porphyrin hole-transporting material which is comparable to that of Spiro-OMeTAD of 18.03%. Based on the similar device structure, Perovskite solar cells using a dimeric porphyrin HTM achieves a PCE of 19.44%.

References: (if applicable)

1. Yella, A.; Mai, C.-L.; Zakeeruddin, S. M.; Chang, S.-N.; Hsieh, C.-H.; Yeh, C.-Y.; Graetzel, M. *Angew. Chem. Int. Ed.*, 2014, 53, 2973.
2. Tingare, Y. S.; Vinh, N. S.; Chou, H.-H.; Liu, Y.-C.; Long, Y.-S.; Wu, T.-C.; Wei, T.-C.; Yeh, C.-Y. *Adv. Energy Mater.*, 2017, 1700032.
3. Chou, H.-H.; Chiang, Y.-H.; Li, M.-H.; Shen, P.-S.; Wei, H.-J.; Mai, C.-L.; Chen, P.; Yeh, C.-Y. *ACS Energy Lett.*, 2016, 1, 956.



Chen-Yu Yeh was born in 1968. He received his BS in chemistry from National Chung Hsing University (NCHU) in 1990, his MS from National Taiwan University (NTU) in 1992, and his PhD from Michigan State University in 1999 under the guidance of professor Chi-Kwong Chang. After postdoctoral studies at MIT with Professor Daniel G. Nocera and at NTU with Professor Shie-Ming Peng, he joined NCHU in 2002, where he is currently a Professor in Chemistry. His research covers synthesis of porphyrins for use in solar cells. He has been recognized with various awards, including the Bau Family Award, Academia Sinica Award for Junior Research Investigators.

