Supporting Information for *Acta Phys. -Chim. Sin.* doi: 10.3866/PKU.WHXB202008050

基于吡嗪空穴传输层的合成及在 *p*-i-*n* 型钙钛矿太阳能电池中的应用

许桂英[1]，薛荣明[1]，张默瑶[1]，李耀文[1,*]，李永舫[1,2]

[1] 先进光电材料重点实验室，苏州大学材料与化学化工学部，江苏 苏州 215123

[2] 中国科学院化学研究所，北京分子科学国家研究中心，北京 100190

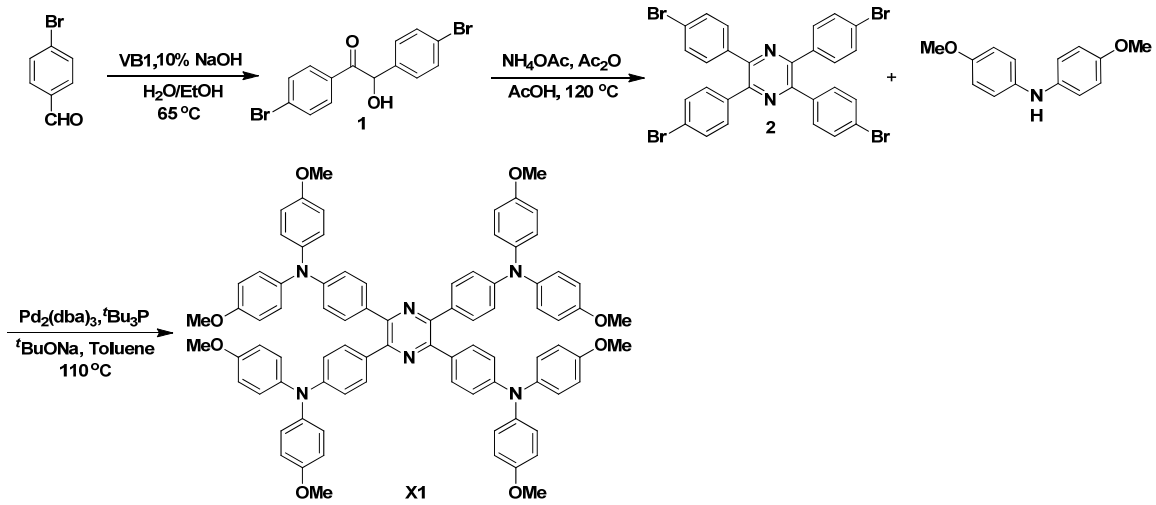
Synthesis of Pyrazine-based Hole-Transporting Layer and Its Application in *p-i-n* Planar Perovskite Solar Cells

Guiying Xu [1], Rongming Xue [1], Moyao Zhang [1], Yaowen Li [1,*], Yongfang Li [1,2]

[1] Laboratory of Advanced Optoelectronic Materials, College of Chemistry, Chemical Engineering and Materials Science, Soochow University, Suzhou 215123, Jiangsu Province, China.

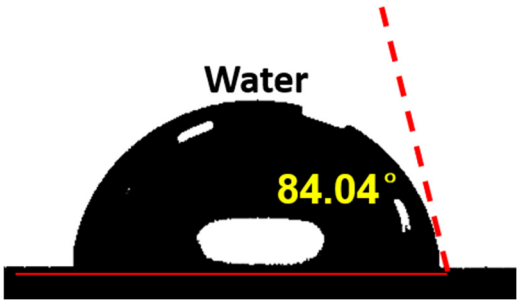
[2] Beijing National Laboratory for Molecular Sciences, Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, China.

[*]Corresponding author. Email: ywli@suda.edu.cn.



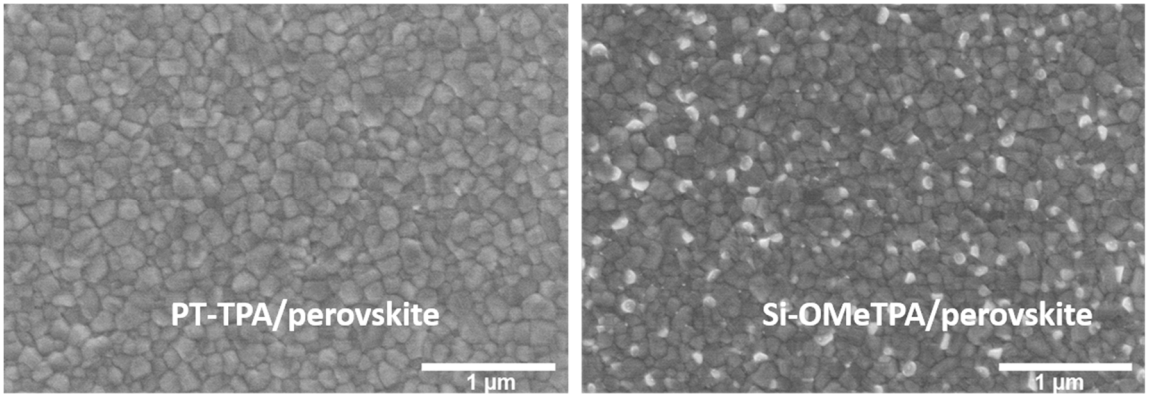
图S1　PT-TPA的合成路线

Fig. S1　Synthesis route of PT-TPA.



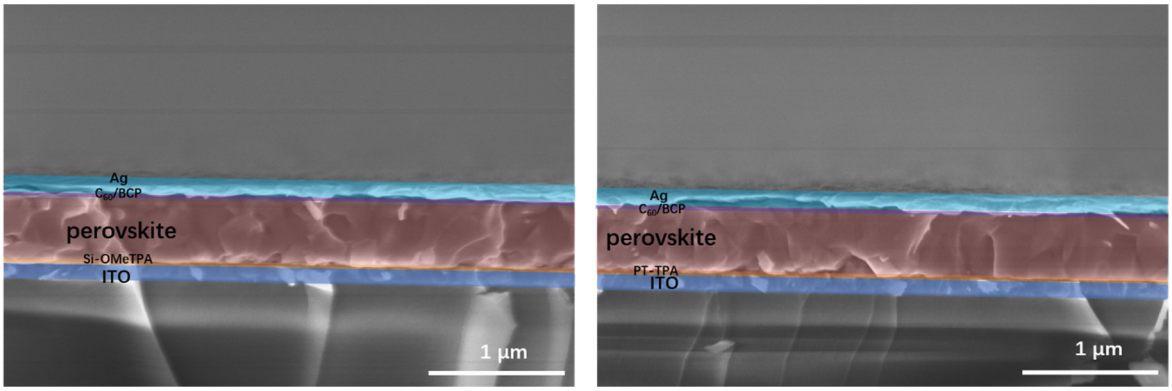
图S2　水滴在PT-TPA表面上的接触角图

Fig. S2　The images of the water droplets contact angles on different surfaces of PT-TPA.



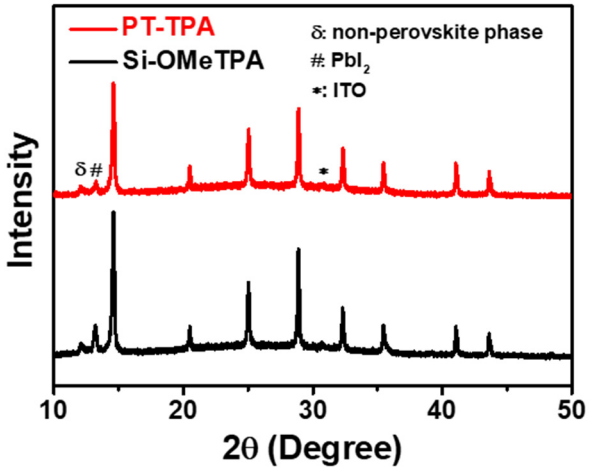
图S3　PT-TPA和Si-OMeTPA表面生长的钙钛矿平面SEM图

Fig. S3　Top-view SEM images of the perovskite films grown on PT-TPA HTL (left) and Si-OMeTPA HTL (right).



图S4　基于Si-OMeTPA和PT-TPA为空穴传输材料的器件截面SEM图

Fig. S4　Cross-section SEM image of *p*-i-*n* pero-SCs based on PT-TPA and Si-OMeTPA HTLs.



图S5　PT-TPA和Si-OMeTPA表面生长的钙钛矿薄膜XRD测试曲线

Fig. S5　XRD patterns of perovskite film grown on PT-TPA and Si-OMeTPA HTLs.

表 S1　不同条件下 PT-TPA 和 Si-OMeTPA 的空穴迁移率

Table S1　Summary of μ_h based on PT-TPA and Si-OMeTPA with different treatments.

	μ_h/(cm^2·V^{-1}·s^{-1})	
	unannealing	annealing
Si-OMeTPA	4.24×10^{-6}	8.80×10^{-5}
PT-TPA	2.81×10^{-5}	2.70×10^{-4}

表 S2　基于不同条件下生长的钙钛矿瞬态荧光 PL 光谱测试相应参数

Table S2　Values for TRPL characteristics of perovskite grown on different HTLs.

HTL	τ_1/ns	f_1	τ_2/ns	f_2	τ_{avg}/ns
none	4.536	0.914%	103.898	99.086%	102.990
Si-OMeTPA	3.444	2.766%	57.083	97.234%	55.599
PT-TPA	2.745	3.226%	52.786	96.774%	51.172

$$\tau_{avg}=\frac{\sum f_i\tau_i^2}{\sum f_i\tau_i}$$