明志科技大學材料工程系107學年四技專題製作競賽

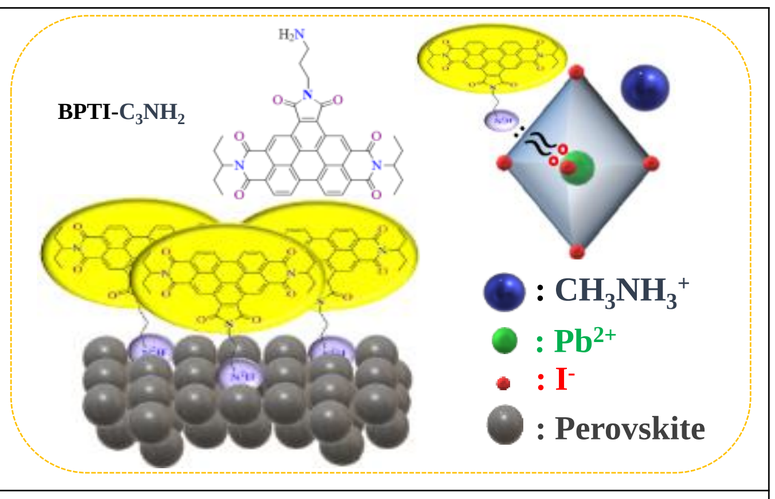
題　　目：**Improving the efficiency of perovskite solar cells by using small molecule passivation defects**

班級/學生：材四甲/李家瑋

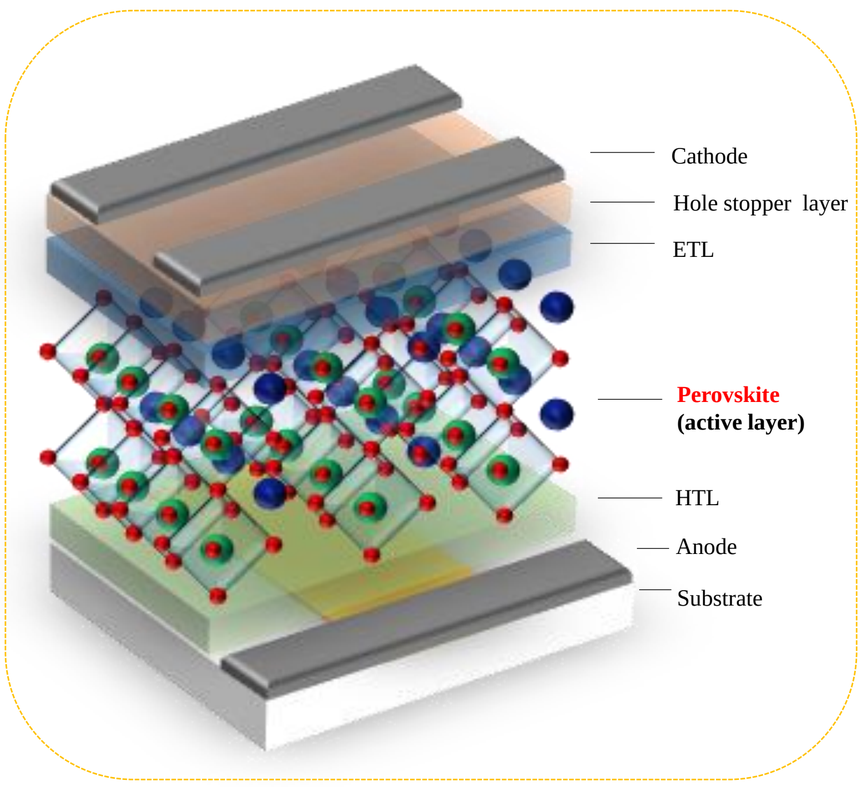
指導教授：陳志平 教授

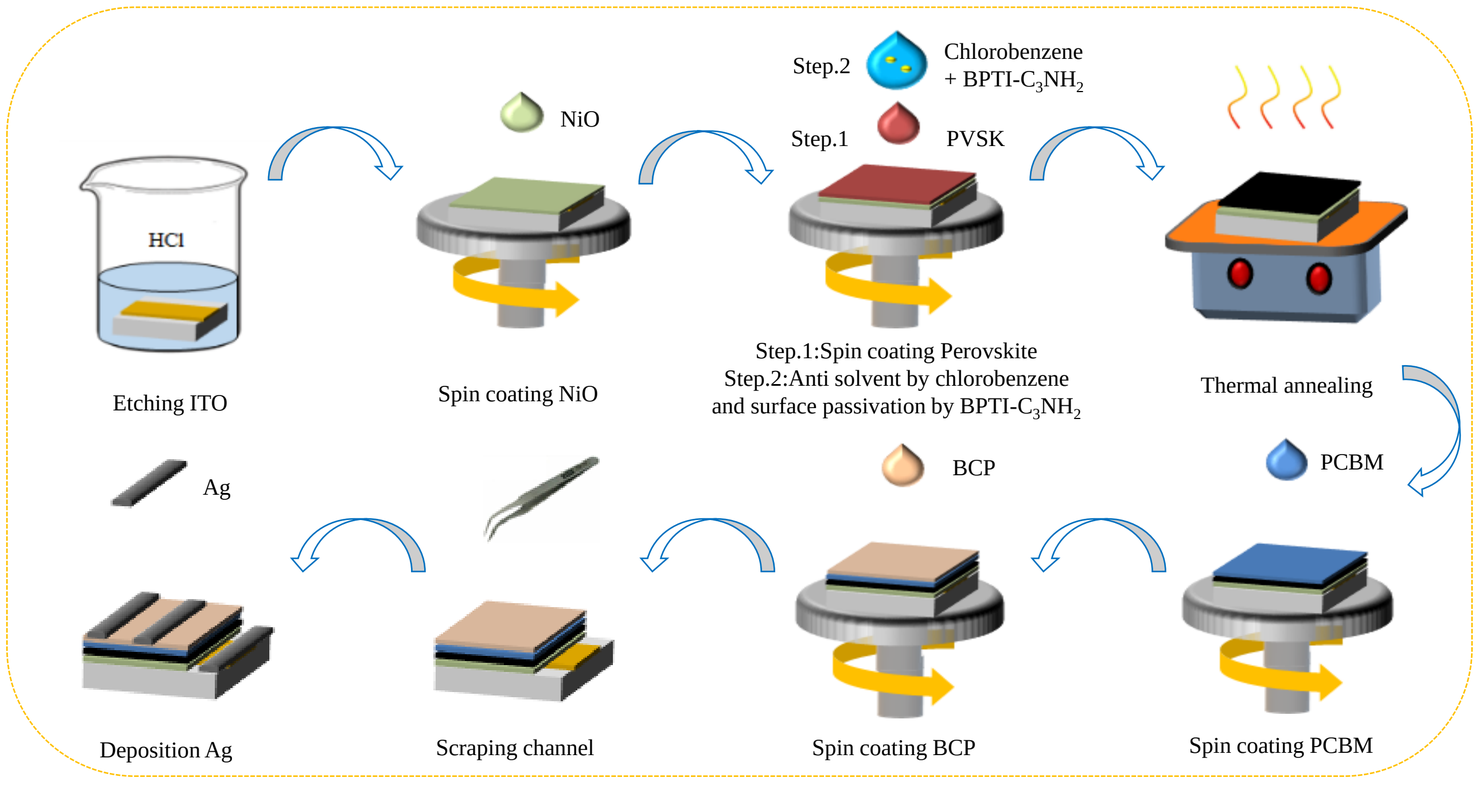
Introduction

Perovskite is composed of ABX_3 structure, which has the characteristics of high absorption coefficient and long carrier diffusion length and excellent carrier mobility to improve the performance of perovskite solar cells. And because perovskite films are usually prepared by solution methods, such wet processes can cause defects, resulting in loss of energy and reduced efficiency, while adjusting the composition to passivate the defects of perovskites can improve PSC performance. Effective means. In this study, the NH_2 (Lewis base) in BPTI-C_3NH_2 and the PB^{2+} (Lewis acid) in the perovskite structure form a Lewis force to passivate the surface defects of the perovskite.(BPTI-C_3NH_2 is provided by National Taiwan University Chemistry hung.cheng.chen professor)

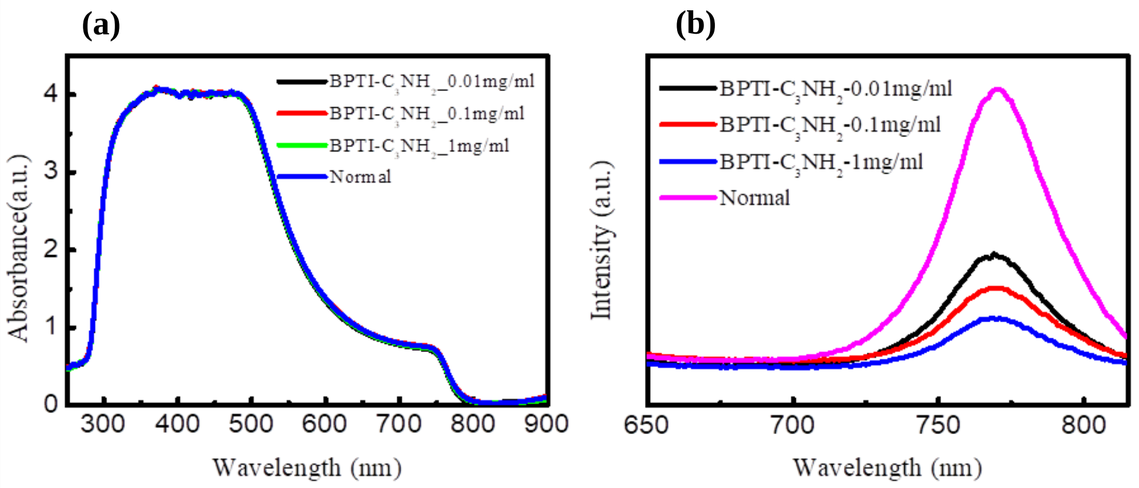


Experimental procedure

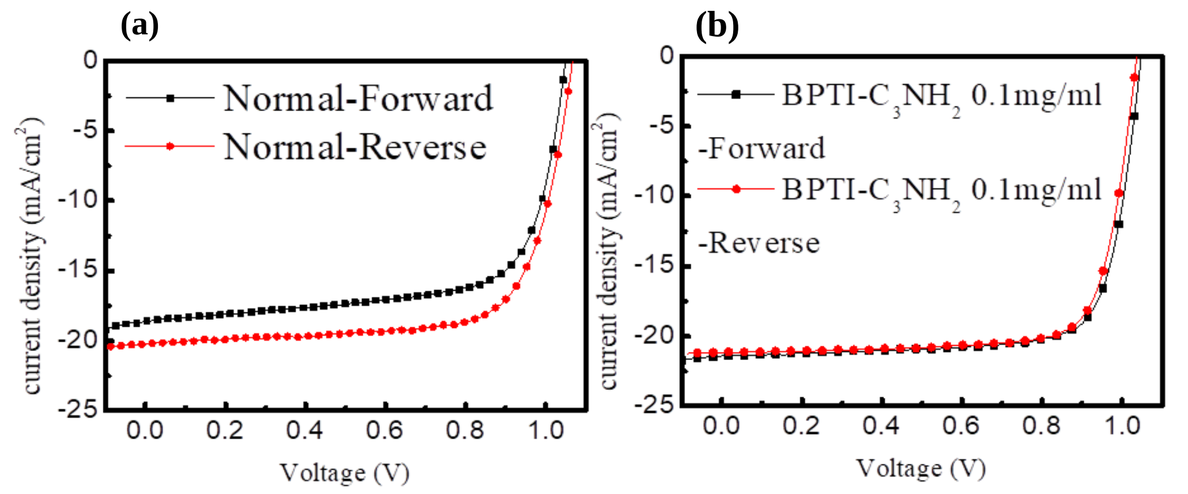




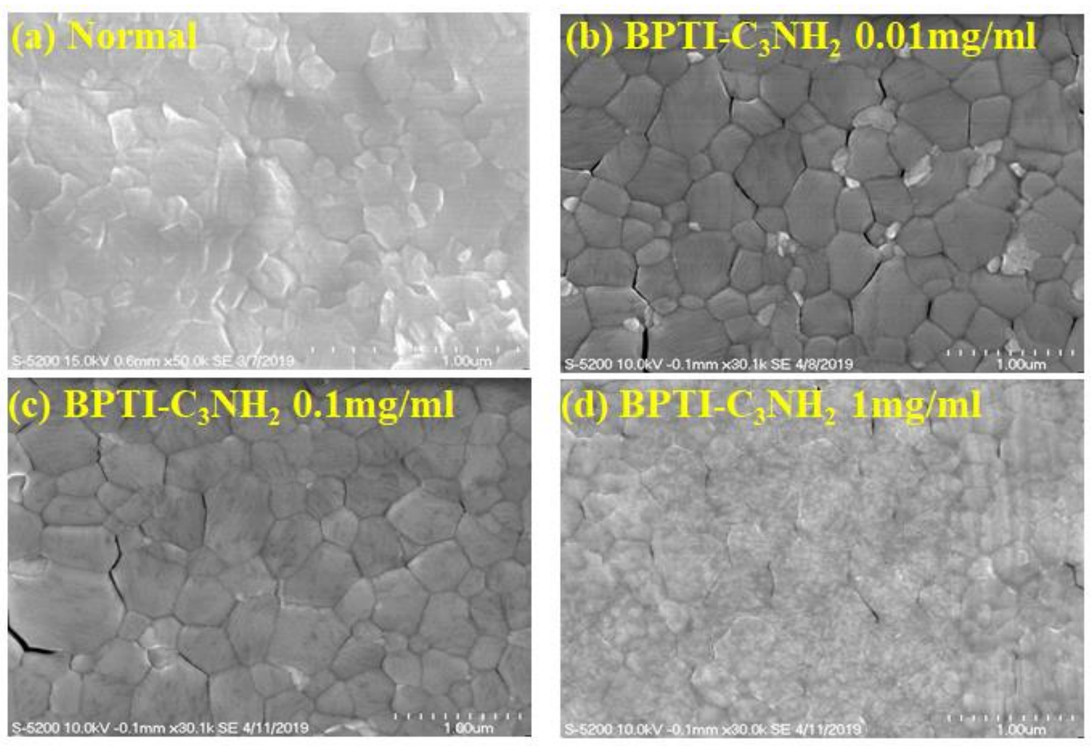
Results and discussion



Optical properties of BPTI-C_3NH_2 dissolve in chlorobenzene Fig.(a)UV-vis-diagram Fig.(b)PL-diagram.



Hysteresis Fig.(a) Normal-Forward and Reverse, Fig.(b)BPTI-C_3NH_2 0.1mg/ml dissolve in chlorobenzene-Forward and Reverse.



Top-view SEM images of Fig.(a) the normal perovskite film and (b–d) those prepared with BPTI-C_3NH_2 (b) 0.01mg/ml, (c) 0.1mg/ml, (d) 1mg/ml.

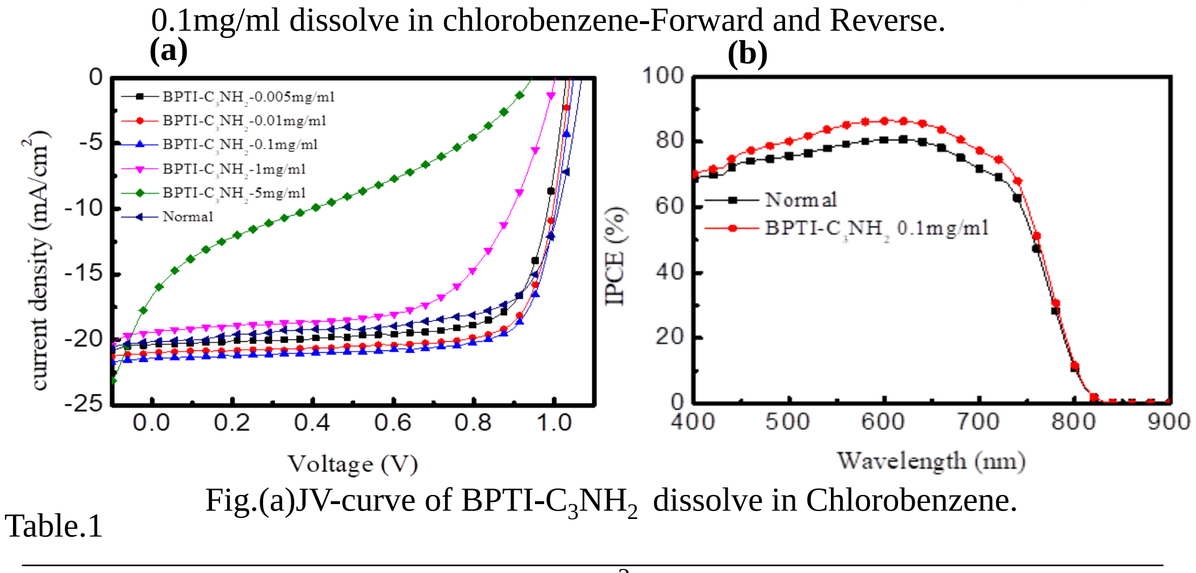


Fig.(a)JV-curve of BPTI-C_3NH_2 dissolve in Chlorobenzene.

Table.1

Parameter		Jsc (mA/cm^2)	Voc (V)	FF (%)	PCE (%)
Normal		20.1	1.04	76.3	16
5mg/ml	BPTI-C_3NH_2	16.5	0.95	29.5	4.6
1 mg/ml	BPTI-C_3NH_2	19.4	1.01	61.2	12.1
0.1 mg/ml	BPTI-C_3NH_2	21.4	1.05	76.6	17.2
0.01mg/ml	BPTI-C_3NH_2	20.1	1.04	77.1	16.8
0.005mg/ml	BPTI-C_3NH_2	20.3	1.03	74.5	15.6

Conclusion

1.Does not affect UV-VIS absorption properties after doping BPTI-C_3NH_2 small molecules to chlorobenzene with passivation defects.

2.After the passivation defect, the excitons are more easily dissociated into electrons and holes, which leads to the decrease of the strength of PL. However, the SEM image shows that doping 1mg/ml BPTI-C_3NH_2 small molecules will form a BPTI-C_3NH_2 small molecule film on the surface, which will affect the electron transport. And the efficiency is reduced.

3.Defect passivation reduces hysteresis and results in more stable efficiency.

References

1.Adv. Energy Mater. 2018, 1802323 (1 and 4 of 9) 2.Adv. Energy Mater. 2016, 6, 1501534 3.Chem. Sci., 2017,8, 4587