GRAPHENE AND 2DM VIRTUAL CONFERENCE & EXPO

Graphene online 2020 October 19-23

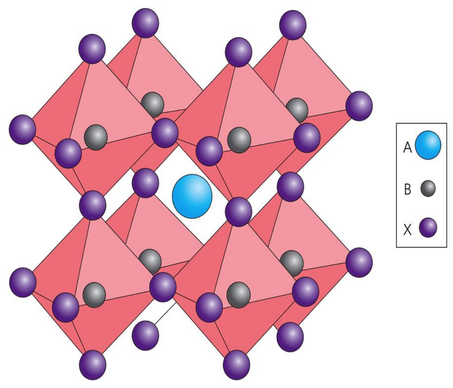
ENHANCING PERFORMANCE AND STABILITY OF PEROVSKITE SOLAR CELLS THROUGH INTERFACE ENGINEERING

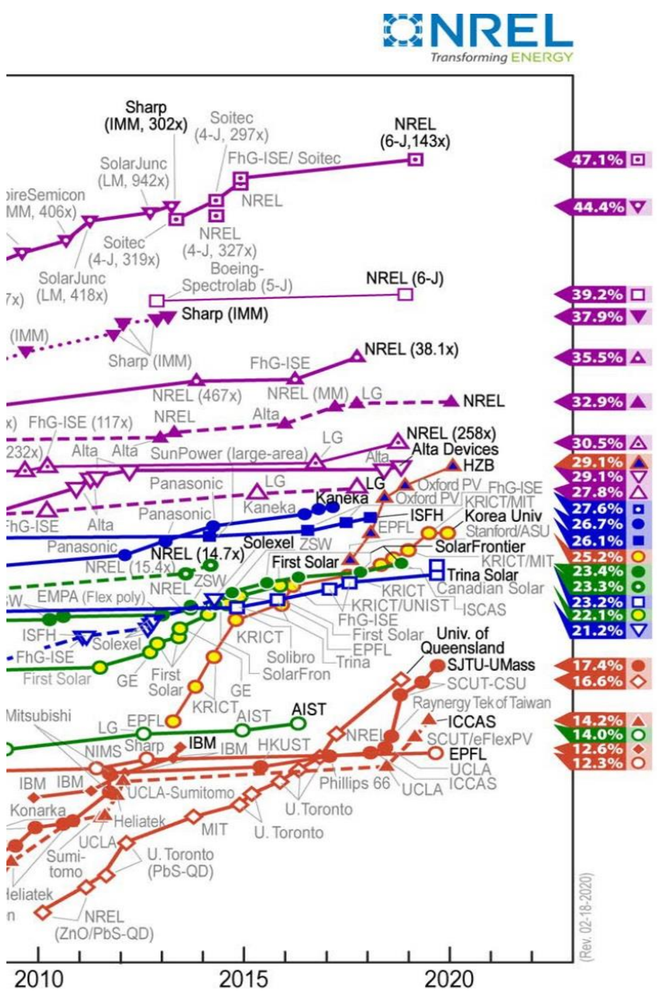
Rajeev Ray, Abdus Salam Sarkar, and Suman Kalyan Pal

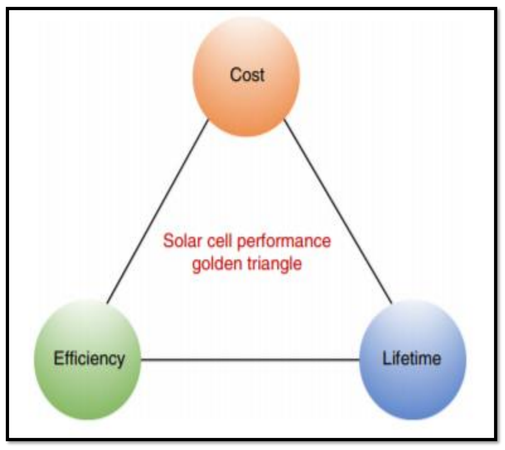
Indian Institute of Technology Mandi

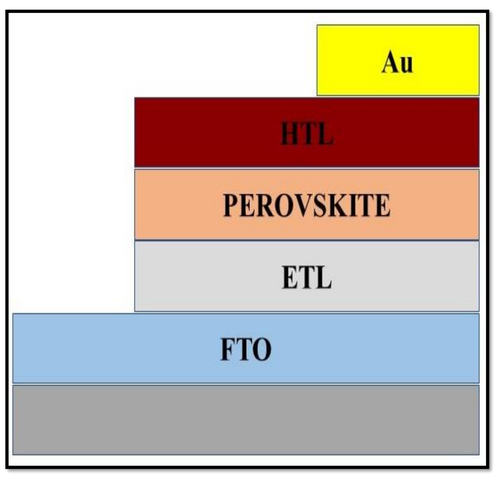
Perovskites materials are described by the formula ABX3, where X is an anion and A and B are cations.

- High efficiency; with an efficiency more than 23% after only several years work.
- Facile low temperature solution-based fabrication method;
- High absorption coefficient.
- High diffusion length, high charge-carrier mobilities



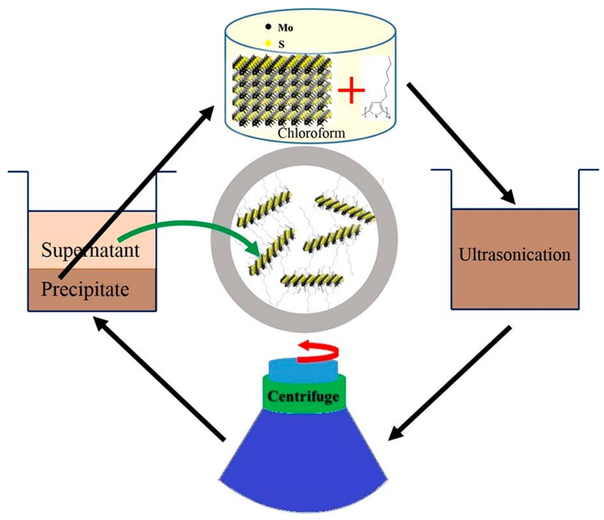






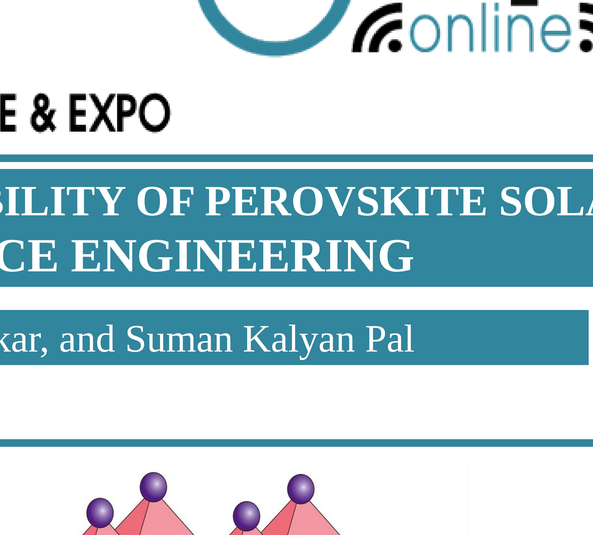
Synthesis of P3HT-MoS_2

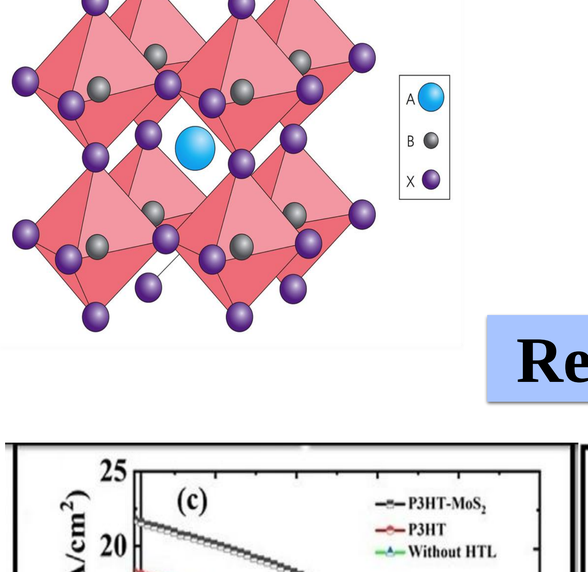
- P3HT : High electrical conductivity and solubility.
- MoS_2 : 2D TMD with high mobility.

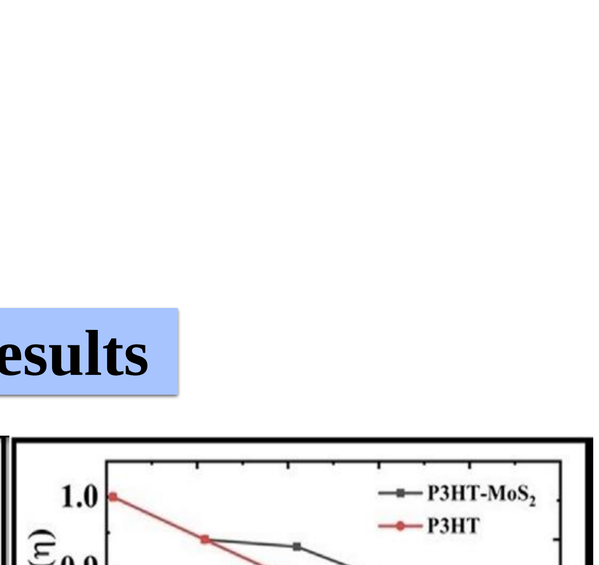


- ❑ Polymer grafted MoS_2 were synthesized according to route adapted by Pal et.al.
- ❑ Bulk MoS_2 was dissolved in of chloroform in a Nitrogen sealed bottle at room temperature followed by magnetic stirring.
- ❑ The nanohybrid obtained show hole mobility enhance by two order $(1.93 \times 10^{-1}\ cm^2\ V^{-1}\ s^{-1})$.

Results







Device HTL	V_{OC} (V)	J_{SC} (mA/cm^2)	FF (%)	PCE (%)
P3HT-MoS_2	0.53	21.3	64	7.2
P3HT	0.48	17.4	60	5.1
No	0.42	4.2	38	0.7

Mobility enhancement of nanohybrid from pristine P3HT thin film

Stability improvement by reducing degradation perovskite layer

Conclusions

- We have addressed the matter of moisture stability of perovskite solar cells through interface engineering.
- The use of polymer grafted 2D MoS_2 as HTL drastically improves the device stability.
- The incorporation of 2D MoS_2 increase both J_{SC} and FF by improving extraction of charge carriers leading to 41% increment in PCE.

CONTACT PERSON

Ultrafast Spectroscopy and Optoelectronics Laboratory (USOL)

I I TMandi, Kamand, Mandi, (H.P.) India

Email: rajeevray148@gmail.com, suman@iitmandi.ac.in

REFERENCES

1. E. J Yoo, M. Lyu, J. H. Yun, C. J Kang, Y. J. Choi, L. Wang, Adv. Mater. 27, 6303 (2015).
2. A. Djurišić; F. Liu, H. Tam, M. Wong, C. Surya, W. Chen, Z. He. Prog. in Quantum Elect. 53, 1 (2017).
3. R. Ray, A. S. Sarkar, S. K. Pal, Sol. Energy. 193, 95-101 (2019).

ACKNOWLEDGEMEN

Rajeev Ray is thankful to IIT Mandi for its fellowship and Advanced Materials Research Centre for the experimental facilities.

Graphene online 2020