

Students' Annual Seminar

On the Development of Two electrode Photo-Rechargeable Metal Ion Batteries

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New ways of directly using solar energy to charge electrochemical energy storage devices such as batteries would lead to exciting developments in energy technologies.

In conventional ways of storing solar energy in batteries, it causes conversion loss and also increases cost, weight, and complexity of storage. This makes the search for alternative methods which can directly charge a two electrode battery system. This envisages providing low cost and light-weight solar batteries which can have a good light to charge conversion factor. In this annual talk, I will first introduce a new concept to make electrodes for two electrode Photo-Rechargeable Metal Ion Batteries. I will also talk about some other methods to prepare efficient electrode material for this future generation of solar batteries.

Here, I will basically talk about a two-electrode photo rechargeable Li-ion battery which is demonstrated using type II semiconductor heterostructures. The staggered energy band alignment of semiconductors limits the electron holes recombination and causes holes to be retained in one semiconductor. The holes generated in the semiconductor pushes the intercalated Li-ions and hence charge the battery. Low band gap, high efficiency photo-conversion and efficient electron-hole separation help the battery to fully charge within a few hours using solar light. The proposed concept and materials can enable next generation stable photo-rechargeable battery electrodes, in contrast to the reported materials.

References:

- [1] Photo Rechargeable Li-Ion Batteries Using Nanorod Heterostructure Electrodes. Kumar, A.; Thakur, P.; Sharma, R.; Puthirath, A. B.; Ajayan, P. M.; Narayanan, T. N. **Small**, 17 (51), 2105029 (2021)
[2] Photo-Rechargeable Organo-Halide Perovskite Batteries. Ahmad, S.; George, C.; Beesley, D. J.; Baumberg, J. J.; De Volder, M. **Nano Lett.**, 18 (3), 1856-1862.(2018)

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05:00 PM (Tea / Coffee 4.45 PM)

Seminar Hall, TIFR-H