



Seminar Topic:

DrIRon Pyrite (FeS₂) for Solar Absorption: A New Look at Old Material

Associate Professor Thirumany Sritharan

Abstract

Iron pyrite has a promise to be a solar absorption material owing to its remarkably high optical absorption, optimal band gap, abundance and non-toxicity. Yet, its solar power conversion efficiency in practice is limited to only about 3 % despite numerous effort to improve it. The underlying reasons for this poor performance are still unclear although, researchers loosely attribute this to impurities and defects. No real experimental evidence to pin point the root causes has been forthcoming. The work reported here explores the problem systematically, in an attempt to pin point root causes.

High purity FeS₂ nanocubes synthesized by a hot injection method were used to produce thin films on glass. They were p-type films. The films were investigated for their structure and properties. They revealed high carrier concentrations, low mobility and a degenerate semiconducting behaviour. Their charge transport behaviour could be described by Mott Variable Range Hopping mechanism over a wide temperature range. These characteristics are manifestations of high intrinsic defect population and crystal disorder despite having achieved single phase pyrite with stoichiometric Fe:S atomic ratio. Ultra-fast transient absorption spectroscopy clearly showed the existence of energy states within the forbidden band gap. It will be concluded that the poor photovoltage generated by pyrite solar devices is due to these intrinsic defects in the material rather than to impurities or secondary phases.

Biography

Dr Thirumany Sritharan joined Nanyang Technological University (NTU) at the inauguration of the Materials Engineering Division in 1992. He obtained his PhD from The University of Sheffield, United Kingdom and worked at The University of Melbourne and Comalco Research Centre, Melbourne before joining NTU. Since joining NTU, he has worked on multiferroic materials with special attention to BiFeO₃ epitaxial thin films and also on various thin film and interfacial problems in microelectronic circuits. Recently he led a NTU team of researchers in a multi-million dollar CREATE program on Solar Energy Conversion that was funded by the NRF Singapore, in collaboration with the University of California, Berkeley. The work reported was done under this CREATE program

Wednesday, 30 October 2019 || Time: 2:00 pm – 3:00 pm

Venue: MSE Meeting Room (N4.1-01-28)

Hosted by: Professor Chen Zhong