

Photovoltaics Laboratory

- [About us](#)
- [People](#)
- [Research](#)
- [Research Facilities](#)
- [Invited/Oral Talks](#)
- [Publications](#)
- [Contact](#)

About Us:

Photovoltaic (PV) Laboratory evolved from a synergetic partnership of researchers ([Link: People](#)) from the Science and Engineering faculties of NUS. The PV laboratory focuses on understanding the fundamental issues governing the energy conversion efficiency of excitonic solar cells and aims at developing cost-effective excitonic solar cells with attractive pay-back time and longevity.

People

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Dr. PALANI, Balaya
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Dr. WANG, Qing
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Dr. XU, Qing-Hua
<http://staff.science.nus.edu.sg/~chmxqh/>

Research Staff

Dr. ANANTHANARAYANAN, Krishnamoorthy

Collaborators

Dr. RAJAN, Jose (NUSNNI)

Dr. THAVASI, Velmurugan (NUSNNI)

Dr. XIE, Zhibin (Dept. of Materials Science and Engineering)

Research Activities:

- Understanding the mechanism of exciton multiplication in semiconducting nanocrystals and its splitting at the interface
- Understanding the factors that control the charge transport through mesoporous materials
- Molecular dynamic simulations of bonding and electron-transfer reactions at the oxide semiconductor / sensitizer / hole conductor interfaces
- Building new prototypes of excitonic solar cells using
 - novel sensitizers (dyes, quantum dots, and biomolecules)
 - compatible photoelectrodes and electrolytes
 - one-dimensional architectures for guided electron transport

Facilities:

Materials synthesis facility

Materials characterization facility (accessed through various departments)

- Thermal Analyzer
- FE-SEM
- X-ray Diffractometer
- HRTEM
- UV-Vis Absorption spectrometer
- Photoluminescence spectrometer
- Multi Channel Potentiostat (14 channels)
 - Impedance spectroscopy (10 μ Hz – 500 kHz)
 - Cyclic voltammetry
 - I-V measurements (potentiostatic/galvanostatic)

Solar Cell Evaluation Facility

- Solar Simulator
- IPCE Measurement
- I-V characteristics

Invited/Oral Talks:

- S. Ramakrishna, "Solar Energy Initiatives and Research Programs Report on New Energy Related Technology and Policy in Singapore, *"The 3rd SEE Forum: Asia-Pacific Academic Network for Sustainable Energy and Environment 21-23 November 2007, Pattaya, Thailand"* (Invited Talk)
- S. Ramakrishna, "Clean Energy Research and Initiatives in the National University of Singapore" *ASEAN COST+3: New Energy Forum for Sustainable Environment (NEFSE) 26-27 May 2008, Kyoto, Japan* (Invited Talk)
- S. Ramakrishna, Perspectives for Low Carbon Society by using clean energy, Open Symposium, *New Energy Forum for Sustainable Environment (NEFSE) 27 May 2008, Kyoto, Japan* (Invited Talk)
- S. Ramakrishna, Nanostructured Ceramic Fibers for Healthcare, Energy, Catalysis and Sensor Applications, *32nd International Conference on Advanced Ceramics and Composites (ICACC-2008)* (Keynote Lecture)
- Z. B. Xie, S. Adams, D. J. Blackwood and J. Wang; "Anodized titania nanotube arrays and their application in dye-sensitized solar cells". *20th Workshop on Quantum Solar Energy Conversion (Quantsol 2008)*, March 2008, Bad Gastein/Austria
- Peng, ZL and S. Adams, "Simulation of dye molecule organization on anatase TiO₂ surfaces". *International Conference on Materials for Advanced Technologies Jul 2007, Singapore*
- Adams, S. and Z Peng, "Simulation of dye and coadsorbent organization on anatase surfaces". *Materials Research Society Spring Meeting 2008, March 2008, San Francisco / United States*
- Adams, S. and Z Peng, "Dye and coadsorbent organization on anatase surfaces from atomistic simulation". *20th Workshop on Quantum Solar Energy Conversion (Quantsol 2008): March 2008, Bad Gastein/Austria.*
- P. Balaya, 'Nanostructured Excitonic Solar Cells' NUS-IIT Chennai Workshop on Current Trends in Physics, IIT-Madras, India 28th Feb. – 1st March 2008 (Invited).

- P. Balaya, 'Nano-size Effects in the Context of Energy Research', 11th Asian Conf. on Solid State Ionics, Coimbatore, India 9th – 13th June 2008 (Invited).

Invited Articles:

- P. Balaya, 'Nano-size Effects in the Context of Energy Research', Proceedings of 11th Asian Conf. on Solid State Ionics, 2008 World-Scientific Pub. Singapore (2008, in print).
- P. Balaya, 'Nanomaterials for Energy Applications', for the first issue of a new journal, 'Energy and Environmental Sciences', Royal Society of Chemistry, UK (2008, invited).
- P. Balaya, 'Nano-ionics in the Context of Energy Systems' for a special issue of the journal Chemical Monthly /Monatshefte fuer Chemie (listed in ISI, Web of Science) entitled 'Solid State Ionics: Electrochemistry meets Materials Science', edited by Juergen Fleig and Werner Sitte from Austria (2008, invited).
- P. Balaya, 'Nanostructured Materials for Energy conversion and Storage' for an edited book on 'Nanomaterials for Sustainable Energy' by S. Banergee and AK Tyagi (BARC, India), Elsevier Publications (2008, invited).

Publications:

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