SOLAR QUEST

SEMINAR ANNOUNCEMENT

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THIRD GENERATION PHOTOVOLTAICS AT UNSW

DATE: Wednesday, February 17, 2010
TIME: 16:45 pm – 17:45pm
PLACE: Lecture Room, Building 4, 2nd Floor

ABSTRACT

There is currently a very rapid increase in production and installation of photovoltaics (PV) worldwide. This is driven primarily by innovative market mechanisms initially in Japan, then in Europe and now in other areas as well, including Australia. However, in order to maintain such an increase from the current level of about 10GW of installed capacity to the several TW required to significantly limit the increase in CO_2 emissions, and hence keep global temperature increase to the 2 C recommended by the IPCC, the "cost per Watt" of PV technologies must be decreased from the current value of about ¥100 to about ¥20. To do this both the cost of production of PV must be reduced, by the use of thin film deposition methods amenable to large scale production, and the efficiency of devices increased.

Third generation PV aims to boost this efficiency of devices above the Shockley-Queisser limit for a single junction device. In addition it aims to use only abundant low toxicity materials and low energy intensity processes. It is thus an extension of Thin Film or second generation PV technology rather than of high quality wafer based first generation technology. Hence as with thin films, third generation approaches aim to be compatible with large scale and large throughput production.

Such an approach is possible because of the large energy losses in a single band gap device due to

non-absorption of below band-gap photons and thermalisation of electron-hole pairs generated by above band gap photons. Third Generation devices tackle these losses through the use of multiple energy levels incorporated in one device. At UNSW three main 3rd Generation approaches are being investigated:

1. Si quantum dot cells: using quantum confinement in Si nanocrystals to engineer the E_g of tandem cells.
2. Up-conversion: in which current in a cell is boosted by absorption of below band-gap photons.
3. Hot Carrier cells: in which the rate of carrier cooling is slowed to allow extraction at higher voltages.

A summary of theoretical and experimental work on these topics at UNSW will be presented.

Solar Quest Host: Assoc. Prof. Yoshitaka Okada, ext. 56501