Abstract of Presentation

Name:
Antonio Luque,

Presentation Title:

Advanced Characterization of Intermediate Band Solar Cells

Abstract :
The Intermediate Band Solar Cell (IBSC) contains an intermediate band (IB) material between two ordinary p and n semiconductors. The IB material has an electron energy band located within the bandgap of an ordinary semiconductor. This cell can yield increased photocurrent because one sub bandgap photon can pump an electron from the valence band (VB) to the IB and a second one can pump the electron form the IB to the conduction band (CB). This mechanism produces a current in addition to the one caused by higher energy photons that pump electrons form the VB to the CB directly, like in ordinary solar cells. This additional current might be produced without loss of voltage because the voltage, like in ordinary cells, is the difference of the electrochemical potentials (quasi-Fermi levels) in the CV and the VB. In consequence additional efficiency is produced with a detailed balance limit of 62% to compare to the 40% limit for an ordinary solar cell.
IBSC can be made using as IB the confined levels of quantum dots. QD must be preferred to higher dimensionality nanostructures because they may cause real density of states (DOS) sub-bandgaps but some QD behave much like quantum wells.
Several groups are working in this concept and Okada's group has produced very promising results with possibly the best extra current and no voltage reduction as compared to the no-QD test structure. Yet, further progress requires the results to be carefully evaluated with detailed bandgap energy spectroscopy and identification of light absorption and recombination mechanisms. For this evaluation low temperature, high light intensity experiments have been carried out in the unique IB-LAB characterization installation at IES-UPM and, among other techniques, can be applied to complement the characterization of the Okada's QD IB solar cells.