GCOE セミナーのお知らせ

Dr. Tetyana Nychyporuk

INSA Lyon, France

8 月 9 日 (月)　(August 9, Monday) 15:00-16:00
金研 COE 棟セミナー室 I (IMR, COE build. Seminar Room I)

Band-gap engineering for Silicon-based third generation photovoltaics

In order to ensure the widespread use of photovoltaic (PV) technology for terrestrial applications, the cost per watt must be significantly lower than 1$/Watt level. Actually the wafer based Si solar cells referred also as a 1st generation solar cells are the most mature technology on PV market. However such PV devices are material and energy intensive with conversion efficiencies which do not exceed in average 16%. One of the most promising strategies for lowering PV costs is the use of thin film (referred also as 2nd generation) technology. It involves low cost and low energy intensity deposition techniques of PV material onto inexpensive large area low-cost substrates. Such processes can bring costs down but because of the defects inherent in the lower quality processing methods, have reduced efficiencies compared to the 1st generation solar cells.

Material limitation of the 1st generation solar cells and efficiency limitation of the 2nd generation solar cells are initiated boring of the Si-based 3rd generation photovoltaics. Its main goal is to significantly increase the conversion efficiency. Among numerous concepts being proposed, the tandem approach is the most promising. Tandem solar cell is a stack of individual cells with different bandgaps each one absorbing the different band of the solar spectrum and thus assuring the optimal absorption of the whole solar spectrum. The novel concepts of Si bandgap engineering in two spectral ranges for tandem solar cells will be presented:

Eg> 1.1 eV: To increase Si bandgap, nanoscale size dependent quantum confinement effect can be used. A new technological approach allowing formation of homogeneous thin film composed of interconnected Si nanocrystals will be presented. It will be shown that the bandgap value of such Si nanostructured material could be adjusted in the large range going from 1.2 to 2.9 eV.

Eg< 1.1 eV: A novel method of Si bandgap decreasing by applying mechanical stresses will be presented. In this approach chemically treated porous silicon plays a role of stress generating material. Strained in volume Si seems to be a promising brick element for the Si-based 3rd generation photovoltaics.

連絡先: 宇佐美　徳隆 (内線2014 , usa@imr.tohoku.ac.jp)