Contribution ID: **332** Type: **Poster**

Epitaxial growth of CuInSe2/InSe/Si heterostructures for photovoltaic applications

Wednesday 20 June 2018 18:00 (20 minutes)

Next generation Si solar cell is heading for the use of ultra-thin Si wafers with the thickness less than 50μm. The challenge is to develop an effective light trapping technology for the PV cells in this category since crystalline Si is an indirect-gap material with a low optical absorption coefficient. In this work, we develop a novel device structure using an efficient light absorption layer of CuInSe2 (CIS) at the bottom of Si homojunction. The device under investigation possesses epitaxial structure on single-crystalline Si substrate. Since the lattice mismatch of CIS/Si is considerable large, the insertion of a thin layer of 2D compound (InSe) at the interface is employed to solve the mismatch problem (so-called van der Waals epitaxy). Device simulation using PC1D indicates that the cell efficiency of a device structure of n-Si/p-Si/InSe/p-CIS may reach 32.5% under AM 1.5 illumination as the wafer thickness down to 5μm. An additional role of InSe is to create a band alignment which is favorable to separate the electron-hole pairs produced in CIS and transport in opposite directions. It is more like a tandem-cell structure so that a decent energy conversion efficiency can be achieved. The simulation has considered the interface recombination and used the up-to-date material parameters reported in the literature. To verify the simulation results, a molecular beam epitaxy (MBE) technique is employed to grown an interfacial layer of InSe on (100)Si prior to the deposition of a CIS film. With the use of a Hg lamp to conduct the photo-assisted growth, we are able to grow epitaxial CIS films at a temperature as low as 300oC. This temperature prohibits the interdiffusion in the heterostructure as confirmed by our TEM microanalysis. The fabrication and properties of the above-mentioned device structure will also be reported in the conference.

Author: Prof. TSENG, Bae-Heng (National Sun Yat-Sen University)

Co-authors: Ms CHENG , Ya-Ru (National Sun Yat-Sen University); Ms WU, Yan-Ting (National Sun Yat-Sen University); Ms HWANG, Jia-Zu (National Sun Yat-Sen University)

Presenter: Prof. TSENG, Bae-Heng (National Sun Yat-Sen University)

Session Classification: Poster Session Wednesday

Track Classification: Electronic Materials & Processing