UNIVERSITÉ DU LUXEMBOURG

Physics seminar

Tuesday, 26th April 2011 at 16h15
(coffee at 16h00)

Belval
Room F.0.11

Talk by Dr. Levent Gütay
Université de Luxembourg

Epitaxy and optical characterization of Cu(In,Ga)Se2 solar cells absorbers

The chalcopyrite alloy $Cu(In,Ga)Se_2$ has successfully entered the stage of thin film solar cell mass production with module efficiencies of up to 13.8%, and world record efficiencies of over 20% for lab scale devices.
In spite of this very successful development, a lot of issues on material properties and resulting loss mechanisms in the absorber material are only partly understood and need further fundamental investigation.
In this talk we will focus on the ternary end-composition $CuInSe_2$ and will discuss the effect of the Cu/In ratio on the structure and quality of the absorber. Samples were grown by metal organic vapor phase epitaxy (MOVPE) and were investigated by photoluminescence (PL), optical transmission spectroscopy, and energy dispersive X-ray spectroscopy (EDX).
Our results show that the Cu/In ratio of the absorber material determines the band gap of the absorber and has a significant influence on the absorber quality in terms of splitting of the quasi-Fermi levels. For higher copper contents we find slightly higher band gap values, and a significantly larger splitting of the quasi-Fermi levels, which is a good measure for the prediction of the open circuit voltage in a finished solar cell.
Our results indicate that an increase of the copper excess during growth (Cu/In-ratio > 1) leads to an increased potential open circuit voltage.
In contrast to this prediction, today's highest efficiency cells are made from slightly copper deficient absorbers. However, this behavior has been explained by higher recombination rates at the junction interface between the copper rich CISe layer and the front contact. The higher potential of the cupper rich material can be exploited with an improved junction interface.

Next Physics Seminars

- **Tuesday, 10th May 2011:**
  Campus Limpertsberg, 16:15
  Kurt Binder, U Mainz
  "Computer simulation of critical phenomena and phase behavior of fluids"
- **Tuesday, 24th May 2011:**
  Belval, 16:15
  Dr. German Olivares, UL
  "Change detection analysis in geodesic time series"
- **Tuesday, 14th June 2011:**
  Campus Limpertsberg, 16:15
  Dominik Berg, UL
  "The formation and characterization of kesterite thin film solar cells – challenges and solutions"
- **Tuesday, 28th June 2011:**
  Belval, 16:15
  Prof. Dr. M. Farle, U Duisburg-Essen
  "Influence of nanoparticle shapes and morphologies on magnetic hardness"