AKE 11: Photovoltaik

Time: Wednesday 16:30–17:30 Location: BEY 118

Invited Talk AKE 11.1 Wed 16:30 BEY 118

Status and Potential of Organic Solar Cells — •Moritz Riede — Institut für Angewandte Photophysik, Technische Universität Dresden, Germany

Organic solar cells have attracted increasing attention in recent years and their development has reached a stage at which several companies are preparing to make them commercially available. Despite lower power conversion efficiencies than their inorganic counterparts, organic solar cells have the potential to become a low-cost alternative, due to low material consumption, simple processing methods as well as the possibility for flexible and light-weight devices. This presentation summarises important recent developments and describes how the synthesis of new organic semiconductors with tailored properties, tuning the morphology of the active layers, adaption of inorganic device concepts like tandem devices, and improved light incoupling have lead to major improvements. It further outlines the current research strategies for improving the basic physical understanding, obtaining higher device efficiencies and lifetimes. Finally, based on the investigated large area production technologies it is shown that the cost can potentially be very low and organic solar cells could address large markets.

AKE 11.2 Wed 17:00 BEY 118

Efficiency enhancement of bulk-heterojunction solar cells. — Michael Krüger[1,2], Yunfei Zhou[1,2], and •Michael Eck[1,2] — [1]Universität Freiburg, Materialforschungszentrum (FMF), Freiburg, Deutschland — [2]Universität Freiburg, Institut für Mikrosystemtechnik, (IMTEK), Freiburg, Deutschland

Inorganic semiconductor nanocrystals (NCs) such as CdSe NCs, with tunable bandgaps and high intrinsic charge carrier mobilities can act as good electron acceptors and be incorporated into conjugated polymers to form bulk-heterojunction hybrid solar cells. Nevertheless their power conversion efficiencies (PCEs) are still lagging behind the PCEs of fullerene based devices but they show high potential for improvement. Here we report on the efficiency enhancement of CdSe NC based devices due to different postsynthetic treatments of the NCs, the use of low-bandgap polymers and optimized device structures including active layer thickness, electrode materials, novel NC hybrid structures and approaches to control the nanomorphology. PCEs approaching 3% and above are available and further enhancement can be expected by exploring and combining the above mentioned approaches.

AKE 11.3 Wed 17:15 BEY 118

GaInP/GaAs/Si Triple-Junction Solar Cell Formed by Wafer Bonding — •Karen Dreyer, Elvira Fehrenbacher, Eduard Oliva, Antonio Leimenstoll, Felix Schätzle, Martin Hermle, Andreas Bett, and Frank Dimroth — Fraunhofer-Institut für Solare Energiesysteme ISE, Freiburg

Multi-junction solar cells utilise the solar spectrum more efficiently than single-junction devices by combining several pn-junctions of different bandgap energy. A combination of GaInP (Eg = 1.9 eV), GaAs (Eg = 1.4 eV) and Si (Eg = 1.1 eV) is nearly ideal for converting the solar spectrum. The direct growth of such highly lattice mismatched semiconductors is challenging. Wafer bonding offers a way for the combination of semiconductors regardless of their lattice constant. This presentation reports on the realization of a highly lattice mismatched triple-junction solar cell. A prefabricated GaInP/GaAs dual-junction and a silicon solar cell are combined by the use of surface activated wafer bonding. In this process the surfaces of the cell structures are cleaned by a beam of argon atoms in a UHV chamber. The wafers are brought into contact immediately after the surface activation which initializes the bonding. Under a solar simulator the GaInP/GaAs/Si triple-junction solar cell had an efficiency of 20.5 % under 1-sun AM1.5 conditions and 23.1 % under the concentrated AM1.5d spectrum (concentration ratio: 48 X). Different factors like the resistance of the bond interface and the current mismatch between the subcells are still limiting the device performance and will be discussed in the presentation.