AKE 1: Photovoltaics

Time: Monday 9:30–11:00 Location: A 151

Invited Talk AKE 1.1 Mon 9:30 A 151

Perspectives and challenges of thin-film crystalline silicon solar cells on glass — •Bernd Rech[1], Daniel Amkreutz[1], Jan Haschke[1], Stefan Gall[1], Christiane Becker[2], Onno Gabriel[3], and Rutger Schlatmann[3] — [1]Institut Silizium Photovoltaik, Helmholtz-Zentrum Berlin, 12489 Berlin, Germany — [2]Nachwuchsgruppe Nano-Sippe, Helmholtz-Zentrum Berlin, 12489 Berlin — [3]PVcomB, Helmholtz-Zentrum Berlin, 12489 Berlin, Germany

Silicon is an abundant, non-toxic material which has evolved to be the dominating raw material for photovoltaic PV devices today. The world-wide market share of solar cells based on multi- or monocrystalline silicon wafers exceeds 80% in a strongly growing market. However, the high energy demand and costs for the production of silicon wafers gave rise to other silicon solar cell technologies aiming at high conversion efficiencies while using much less high quality crystalline silicon. Only recently, the liquid phase crystallization (LPC) of amorphous or nanocrystalline silicon thin-films directly on a glass substrate has received increased attention for photovoltaics. By using an electron-beam line source or a line shaped laser moving across the substrate the entire silicon precursor film is molten and subsequently recrystallizes. We will present our latest progress in fabricating high quality crystalline silicon thin film solar cells on glass highlighted by efficiencies of 12 % and open-circuit voltages Voc well above 600 mV with a maximum value of 656 mV. So far, such high Voc values have only been achieved on wafer-based silicon solar cells.

AKE 1.2 Mon 10:00 A 151

Computational studies of material properties in $CuInSe_2$ photovoltaic solar cell material — Laura Oikkonen[1], Maria Ganchenkova[2], •Ari Paavo Seitsonen[3,4], and Risto Nieminen[1,5] — [1]COMP Centre of Excellence, Department of Applied Physics, Aalto University, Espoo, Finland — [2]Department of Materials Science, National Research Nuclear University, Moscow, Russia — [3]Institut für Chemie, University of Zürich, Switzerland — [4]Département de Chimie, École Normale Supérieure, Paris, France — [5]Dean's Office, Aalto University, Finland

$CuInGaSe_2$ (CIGS) is considered as a highly efficient material in thin film solar cells. In recent years we have performed several studies of the properties of the $CuInSe_2$ (CIS) material, ranging from point defects [1], importance of Se-related defects [2], mass transport in CIS [3], incorporation of Na into CIS [4], and clustering and diffusion of defects [5]. We discuss the relation of our results with the experimental findings and the overall material properties of CIGS.

[1] LE Oikkonen, MG Ganchenkova, AP Seitsonen and RM Nieminen, Journal of Physics: Condensed Matter 23 (2011) 422202
[2] *ibid*, Physical Review B 86 (2012) 165115
[3] *ibid*, Journal of Applied Physics 113 (2013) 133510
[4] *ibid*, Journal of Applied Physics 114 (2013) 083503
[5] *ibid*, Journal of Physics: Condensed Matter 26 (2014) 345501

Invited Talk AKE 1.3 Mon 10:15 A 151

Neue optoelektronische Materialien und Verfahren für die Photovoltaik — •Christoph Brabec — iMEET @ Friedrich Alexander University Erlangen Nürnberg

Lösungsprozessierte Halbleiter finden immer mehr Bedeutung in der Entwicklung von optoelektronischen Bauteilen. Diese Klasse von Halbleiter umfasst die organischen Halbleiter, kolloidale Nanokristalle und Nanopartikel als auch hybride Halbleitersysteme. Die gezielte Optimierung der einzelnen Materialsysteme führte zu einer beachtlichen Qualitätssteigerung in diesen Materialklassen, die sich eindrucksvoll in der Effizienzkurve für photovoltaische Bauelemente widerspiegelt. Organische lösungsprozessierte Solarzellen als auch kolloidale Nanopartikelkomposite erreichen Effizienzen von 9 - 11%, hybride lösungsprozessierte Halbleiter wie die Perovskite erreichen Effizienzen von über 20 %. Die kontinuierliche Verbesserung der Halbleiter wird begleitet durch neue Architekturen als auch durch innovative Konzepte in der Lichteinkopplung bzw. Lichtmanipulation, so dass eine weitere stetige Verbesserung in der Performance von gedruckten Solarzellen zu erwarten ist. In diesem Vortrag werden die opto-elektronischen Eigenschaften dieser neuen Halbleitersysteme und deren Verwendung in der Photovoltaik diskutiert. Neue Solarzellen Architekturen, die speziell für die Lösungsprozessierung entwickelt wurden, werden vorgestellt. Erste Applikationen versuchen die Alleinstellungsmerkmale dieser Technologie zur Geltung zu bringen - Eigenschaften wie Transparenz und die Farbgebung spielen hier eine große Rolle.

AKE 1.4 Mon 10:45 A 151

Recent progress in organic photovoltaics — •Johannes Widmer, Christian Koerner, and Karl Leo — IAPP (Institut für Angewandte Photophysik), TU Dresden, Germany

Organic solar cells are today manufactured as flexible, light weight "solar films". These modules can be designed in various colors, and they are optionally available as semi-transparent foils. These properties illustrate some of the advantages which organic photovoltaics have over their established inorganic counterparts. And though absolute efficiencies of organic photovoltaics are still below those of silicon solar cells, they have reached a level where their unique characteristics start to make them interesting for commercial applications.

In this contribution, we give a compact overview over the scientific and technological specifics of organic photovoltaics. We outline prevailing topics and challenges in research and development, and discuss promising application scenarios. Thereby we illustrate, why organic solar cells might soon be found in places where today we do not think about photovoltaics yet.