JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

Kolloquium des
Zentrums für Materialforschung (LaMa)

Hybrid Perovskites in Photovoltaics

Freitag, 17. Februar 2017
Hörsaal C 5a, neue Chemie, Heinrich-Buff-Ring 19

14:00 Uhr *Dr. Giulia Grancini*
EPFL Valais Wallis, Sion, Schweiz
Interface engineering for high efficient and stable perovskite solar cells

15:00 Uhr Break with Coffee and Cake

15:30 Uhr *Prof. Dr. Thomas Lenzer*
Universität Siegen, Physikalische Chemie
Charge carrier dynamics of organic-inorganic hybrid perovskites

Gäste sind herzlich willkommen!

Die Dozenten des Zentrums für Materialforschung

Kontakt
Dr. Thomas Leichtweiß
Zentrum für Materialforschung (LaMa) - Justus-Liebig-Universität Gießen
Heinrich-Buff-Ring 16 - 35392 Gießen - Tel.: +49-641-99 33601
https://www.uni-giessen.de/lama zfm@materialwiss.uni-giessen.de

Interface engineering for high efficient and stable perovskite solar cells

Giulia Grancini

EPFL Valais Wallis EPFL SCI-SB-MN, Rue de l'Industrie 17, Case postale 440, CH-1951 Sion

giulia.grancini@epfl.ch

The world global installed photovoltaic capacity will likely reach up to 5000 GW by 2050. At this moment, solar energy will likely be one of the major electricity source worldwide, with the lowest costs and environmental impact. New photovoltaic (PV) technologies with higher potential performances at lower price will lead this paradigm shift. In this context, the World Economic Forum has recently recognized Perovskite solar cells (PSCs) as one of the top 10 technologies in 2016[1]. Indeed, PSCs have emerged as one of the most exciting fields of research of our time, for their impressive rise in their power conversion efficiency (PCE) surpassing 22% in a short of six years research[1]. PSCs are leading a real revolution in power generation, standing over the main technologies on the market [1, 2]. Typically, the solar cell consists of a multi-layered structure where the perovskite is sandwiched between an electron transport layer, generally the mesoporous titanium dioxide (TiO_2), and a hole transporting material [2]. Light is absorbed by the perovskite, free carriers are generated and injected into selective top and bottom layers. This configuration, known as “mesoporous” solar cells, is the one that at present holds the efficiency records.[1] High performances can be obtained through a molecular engineering of the perovskite composition, however, device physics and operation is still subject of intense debate. In addition, poor device stability (mainly due to degradation in ambient conditions) put severe limits to the uptake of this technology. Here I will overview the main properties of high efficient perovskite solar cells in terms of structural, optical and photophysical behavior of the perovskite and of the device under operation[3]. A particular emphasis is given to the role of the active interfaces and the processes therein, such as charge injection, trapping, charge recombination, happening over timescales form femtoseconds to nanoseconds, which ultimately govern the device performances. Finally, new direction to solve the stability issue will be presented focusing on the idea to engineer a multidimensional perovskite structure that delivers a record stability value of 8,500 hours with zero efficiency loss[4].

References

1. http://www.nrel.gov/ncpv/images/efficiency_chart.jpg, “National Renewable Energy Laboratory Best Research-Cell Efficiencies”.
2. Saliba, M.; Orlandi, S. et al. Nature Energy, 2016, 1, 15017.
3. P. Gratia, P. ; G. Grancini,* et al. J. Am. Chem. Soc., 2016 DOI: 10.1021/jacs.6b10049
4. Grancini G. et al. https://arxiv.org/ftp/arxiv/papers/1609/1609.09846.pdf.

Charge carrier dynamics of organic-inorganic hybrid perovskites

Johannes R. Klein, Oliver Flender, Mirko Scholz, Jonas Hölzer,

Kawon Oum and Thomas Lenzer**

Universität Siegen, Physikalische Chemie, Adolf-Reichwein-Str. 2, 57076 Siegen

Organic-inorganic hybrid perovskites have emerged as promising materials for applications in solar cells and optoelectronics. Optimizing the performance of such devices requires a detailed knowledge of their carrier dynamics. We present results employing ultrafast pump - supercontinuum probe spectroscopy in the UV-Vis-NIR range for a wide range of carrier densities. Topics include timescales for carrier recombination and cooling as well as confinement effects in low-dimensional perovskite structures.[1,2] We will discuss carrier injection at the interfaces between perovskite and mesoporous TiO_2 and also between perovskite and triarylamine-based hole transport materials.

(1) J.R. Klein, O. Flender, M. Scholz, K. Oum* and T. Lenzer*, *Phys. Chem. Chem. Phys.*, 2016, **18**, 10800.

(2) O. Flender, J.R. Klein, T. Lenzer* and K. Oum*, *Phys. Chem. Chem. Phys.*, 2015, **17**, 19238.