École polytechnique fédérale de Lausanne (EPFL) Valais/Wallis
Institute of Chemical Sciences and Engineering (ISIC)
Basic Science Faculty (SB)
Energypolis, Rue de l'Industrie 17, CH-1950 Sion, Switzerland

SEMINAR SERIES

HIGHLIGHTS IN ENERGY RESEARCH

8. 3. 2018, 10.30 – 11.30, ENERGYPOLIS Sion, 4th floor, ZEUZIER room

Interface engineering and physics therein for high efficient and stable perovskite solar cells

Giulia Grancini

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

New photovoltaic (PV) technologies, delivering high performances at low price, are ideal candidates to sustain the actual paradigm shift towards a carbon-free economy. In this context, Perovskite Solar Cells (PSCs), pioneered by methylammonium lead-iodide ($CH_3NH_3PbI_3$) perovskite, are leading the photovoltaic scenario, showing impressive power conversion efficiency beyond 22% reached upon only six years of research.[1] PSCs consist of a layered device where the perovskite is sandwiched between an electron transport layer (i. e. mesoporous titanium oxide), and an organic hole transporter.[2] Light is absorbed by the perovskite, free carriers are generated and injected into the selective contacts. High performances have been obtained by fine-tuning the perovskite composition and by engineering the device interfaces. However, poor device stability (=short lifetime) mainly due to water-induced degradation, is the actual challenge. Here, I will present our innovative approach to realize efficient and stable devices by controlling the fundamental photophysical processes, such as charge injection, trapping, charge recombination, (happening over timescales form femtoseconds to nanoseconds), at the device interfaces and manipulating them to create new functionalities. To this regard, we propose a new multidimensional PSC by designing new hydrophobic compounds - to reduce the water induced degradation - and by engineering stable multidimensional interfaces. The multi-dimensional PSC deliver high efficiency (over 20%) and a record stability value of 11,000 hours, corresponding to more than one year operation, with zero efficiency losses. [2]

References:

[1] http://www.nrel.gov/ncpv/images/efficiency_chart.jpg, "National Renewable Energy Laboratory Best Research-Cell Efficiencies".
[2] G. Grancini et al. "One-Year stable perovskite solar cells by 2D/3D interface engineering" Nat. Comm. 8 (15684), (2017)

CV: Dr. Giulia Grancini
is Team Leader at the EPFL Valais awarded in 2017 with an Ambizione Energy fellowship. Graduated from Politecnico of Milan in 2008 (MS in Physical Engineering), she obtained her PhD in Physics in 2012 working on ultrafast phenomena at organic interfaces. In 2010 she was visiting scientist at Oxford University where she pioneered new concepts within polymer/oxide solar cell technology. From 2012-2015, she has been Post-Doc researcher at the Italian Institute of Technology in Milan. Since 2015, she joined the group of Prof. Nazeeruddin at EPFL, awarded with a Marie Skłodowska-Curie Fellowship. She is author of 65 papers (h-index=26, 7000 citations). Her work focuses on the current scientific challenge of exploring the fundamental photophysical processes underlying the operation of advanced optoelectronic devices, with a special attention to new generation photovoltaics.