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Energy Colloquium

On the Way Toward Efficient Perovskite Photovoltaics and Beyond

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Skoltech &
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15 November 2016, 16:00

Skolkovo Innovation Center

Technopark, Building 3, Room 402

ABSTRACT:

Present day electronic devices are enabled by design and implementation of precise interfaces that control the flow of charge carriers. Solution-processed organometallic perovskite based solar cells have emerged as a promising thin-film photovoltaic technology. Here, I will describe a novel solution-processed technique to grow high quality large-area mm-scale perovskite crystals leading to highly efficient (18%) and reproducible solar cells with reduced defect induced recombination. Theoretical simulations rationalize specifics of electronic structure of these materials, presence of interfacial states, bimolecular recombination rates and reduced losses of carriers. Ensuring photo-stability over prolonged solar irradiation a key challenge in these materials. We observe the photo-degradation and fast self-healing of the photocurrent in perovskite solar cells under constant illumination. We attribute the photocurrent degradation to the formation of light-activated small polaron trap states. Experimental characterization and theory suggest their origin to the formation of localized charged states strongly coupled with local structural lattice distortions and methyl ammonium quasistatic configurations. Finally, I outline results on 2D layered hybrid perovskite, which was incorporated into a photovoltaic device that exhibited a world-record efficiency (13% in the category of 2D materials) and stability for over 3 months under constant light illumination and 65% humidity. Overall, our results provide insight towards the material design for efficient and photo-stable perovskite solar cells.

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Colloquium schedule and information on how to get to the colloquium can be found at *http://www.skoltech.ru/en/energy-colloquium/*