Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Alexandre Yersin Department of Solar Energy and Environmental Physics

Perovskite and their applications in photovoltaic cells, nanostructures, semitransparency and low dimensional perovskite

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Abstract:

Photovoltaic cells (PVCs) use semiconductors to convert sunlight into electrical current and are regarded as a key technology for a sustainable energy supply. The 1st and 2nd generations of PV technology were based on bulk semiconductor solids, accompanied by a relatively high manufacturing cost. The 3rd generation of PV cells, developed over the past two decades, differ from previous cells in that they don't necessarily rely only on a traditional single p-n junction configuration. Instead, they are configured as donor-acceptor (D-A) hetero-junctions, with staggered electronic band alignment. These 3rd generation PV cells also carry a lower manufacturing cost.

Recent discoveries have revealed a breakthrough in the field using inorganic-organic hybrid layers called perovskites as the light harvester in the solar cell. The inorganic-organic arrangement is self-assembled as alternate layers, being a simple, low cost procedure. These organic-inorganic hybrids promise several benefits not delivered by the separate constituents. This work will discusses new directions related to perovskite and their applications in solar cells.

In low dimensional systems, stability of excitons in quantum wells is greatly enhanced due to the confined effect and the coulomb interaction. The exciton binding energy of the typical 2D organic-inorganic perovskites is up to 300 meV and their self-assembled films exhibit bright photoluminescence at room temperature.

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Date & Location:

Tuesday, May 13, 2020, 11:0 Lecture room, Physics Building (ground floor)

- In this work we will show the dimensionality in the perovskite structure. The 2D perovskite structure should provide stable perovskite structure compare to the 3D structure. The additional long organic cation, which is added to the perovskite structure (in the 2D structure), is expected to provide hydrophobicity, which will enhance the resistivity of the perovskite to humidity. Moreover, we will demonstrate the use of 2D perovskite in high efficiency solar cells.

- Moreover, we will show a highly efficient semitransparent perovskite solar cell. The semitransparency was achieved through a mesh assisted evaporation technique when a grid of perovskite is created on the TiO2 surface. The perovskite grid allows to get controlled semitransparent perovskite solar cell.

- Organic-inorganic halide perovskite is used mainly in its “bulk” form in the solar cell. Confined perovskite nanostructures could be a promising candidate for efficient optoelectronic devices, taking advantage of the superior bulk properties of organo-metal halide perovskite, as well as the nanoscale properties. In this talk, I will present our recent progress related to the synthesis and characterization of perovskite NPs- i.e. Inorganic and hybrid organic-inorganic NPs. New nanostructures such us: NRs and NWs will be presented and the introduction of other cations such us Rb will be shown.