Project 1: Ion migration in perovskite solar cells

Daily supervisor: Lucie McGovern

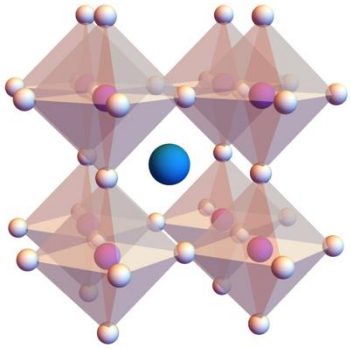

Figure 1. Perovskite crystal structure

Perovskite solar cells are on the verge to large-scale commercial application, but the most efficient perovskites are still not long-term stable. Ion migration has been attributed to cause long-term degradation. In the hybrid solar cells group we recently established a novel technique, transient ion-drift (TID) to accurately quantify ion migration. The technique relies on measurements of the transient capacitance decay after a voltage pulse at various temperatures. It allows to measure the activation energy, density, and diffusion coefficient of the mobile ions.

In this project you will study where ions migrate in the perovskite films. You will fabricate perovskite solar cells with varying grain size, and study the migration of anions an cations with TID. The results will allow to distinguish the ion migration in the bulk and on grain boundaries, which can guide the development of future perovskite materials for stable solar cells.

Project 2: Solar cell efficiency limit of singlet fission solar cells

Daily supervisor: Benjamin Daiber

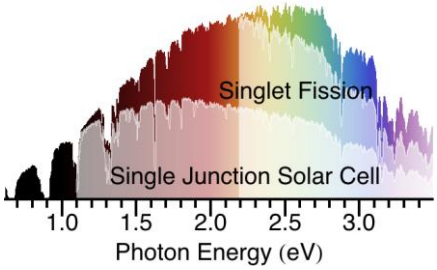

Figure 2. Light harvesting of the solar spectrum with singlet fission

Singlet fission is a process by which the absorption of one high-energy photon leads to two lower-energy excited states. In solar cells this can lead to a current-doubling from the high-energy photon, and thereby, in principle, to efficiencies exceeding the Shockley-Queisser limit.

In this project you will calculate how efficient the singlet fission solar cells could become if we used realistic parameters. You will use and extend a computational model recently developed in the group, and predict the power conversion efficiency, compared to conventional silicon cells and to tandem solar cells. The results of the project will guide the research on future singlet fission solar cells.

About the group

The Hybrid Solar Cell Group focuses on novel paths towards more efficient solar cells using both organic and inorganic materials. We aim at combining the unique properties and the richness of organic materials with the highly efficient, well-characterised inorganic materials. We provide a highly collaborative environment, both within the group and with our national and international collaborators.

You will be part of a sub-group relating to the topic, and supervised by an experienced PhD student. Duration of both projects is 10 months full time.

More information about the group at https://amolf.nl/research-groups/hybrid-solar-cells, on Twitter @brunoehrler and via email at ehrler@amolf.nl.