



PhD position opening

ESPCI Paris, PSL Research University (Université de Recherche Paris-Sciences-et-Lettres)
Ecole Doctorale Physique et chimie des Matériaux (ED 397)

« Physics of Degradation in Organic, Nanocrystal, and Hybrid solar cells »

Project description : Researchers in the field of photovoltaic devices based on organic, inorganic colloidal quantum dots (QDs) and organic-inorganic perovskite halide materials have witnessed remarkable progress over the past decade. The majority of research efforts have been focused on the improvement of the power-conversion efficiency of these devices, leading to a significant increase of this figure-of-merit to >13% for organics and QD and >22% for perovskites. This progress and additional advantageous properties, such as ease of processibility, low-cost, light-weight, flexibility and semi-transparency make these devices a contender for potential new industrial applications. However, when compared to silicon-based solar panels, which typically have a lifespan of 25 years, most solution-processed 3rd-generation solar cells suffer from various degrees of material degradation related to the environment they are exposed to. Degradation, thus currently represents one of the utmost pressing issues preventing their large-scale application and exploitation.

This PhD program aims to aim to (1) identify the fundamental causes of degradation of organic, inorganic nanocrystal and hybrid organic-inorganic thin films; (2) understand the physical origin of degradation, i.e. the formation of degradation products; (3) correlate the changes in device characteristics to the causes identified; and (4) develop strategies to improve material and device stability. It can be anticipated that through this study we will gain fundamental understanding of how different choices of materials (organic, nanocrystal, or hybrid components), their synthetic and surface chemistry, and different device architectures, impact on the device degradation mechanisms. Understanding these aspects will not only lead to organic, QD and hybrid solar cells with improved device lifetimes, but also offer material and device design guidelines for further optimization of future 3rd-generation photovoltaics.

This 36-month PhD project will be carried out by a tight collaboration between two research teams from Heidelberg University (Germany) and the LPEM (Laboratoire de Physique et d'Etude des Matériaux, a research unit of CNRS/ESPCI-Paris/Sorbonne Université) under the framework of a funded ANR France-Germany research collaboration project. The project will build on the strength and expertise of these two teams to allow for a multidisciplinary investigation.

Location : The PhD student will be based at LPEM (Laboratoire de Physique et d'Etude des Matériaux, CNRS-UMR 8213) of ESPCI Paris, 10 Rue Vauquelin, 75005 Paris

Short collaboration visits at Heidelberg University (Germany) will be planned during the 3-year PhD program.

Facility : In ESPCI, the PhD student will have access to all equipments of the Micro & Nano Characterization (MNC) Group and all shared facilities at ESPCI (transmission and scanning electron microscopy, XRD, ESPCI cleanroom, mechanical workshop...etc.). The PhD student will also have access to all equipments through the platform of 'Centrale de Proximité Paris-Centre' (a network which gathers different cleanrooms in different institutes in Paris).

Starting date and duration : 17/09/2018, for 36 months (expected PhD graduation in September 2021)

Candidate profile : Solid academic background and a Master Degree on chemistry, material science, or applied physics. Good speaking & writing skills in English. Hard-working and passionate in scientific experiments.

Supervisor : Zhuoying CHEN (LPEM, CNRS/ESPCI Paris)

Application method : CV + motivation letter + 2 reference letters to be sent to zhuoying.chen@espci.fr. There is no application deadline but the position will be filled as soon as a suitable candidate is identified.