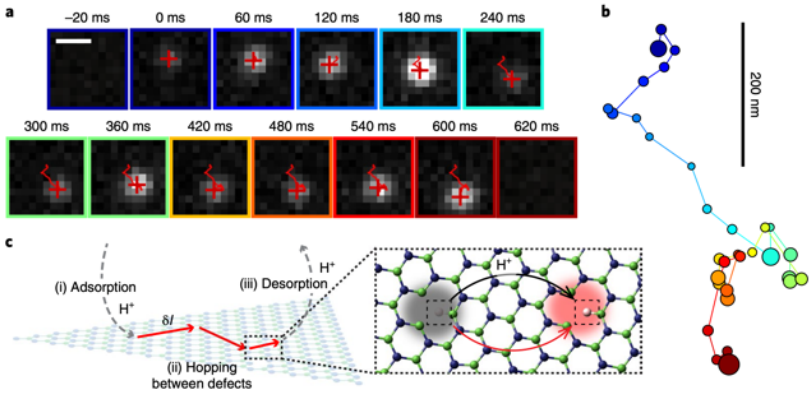
Postdoctoral Position

Probing solid/electrolyte interfaces with single-charge nanofluidics

Ionic charge transport processes at the interface between solid surfaces and liquid electrolytes are at the heart of a number of energy and environment related applications (blue energy, super-capacitors and batteries, nanofiltration…). However, our fundamental understanding of these dynamic interfacial processes remains poor, due to the strong experimental barriers related to the exploration of ionic charge dynamics at the intimate scale of the interface.

In this context, we recently demonstrated that optically active defects hosted at the surface of 2D hexagonal Boron Nitride (hBN) crystals can be used as optical markers to track the motion of single H^+ proton charges at the hBN/water interface (see figure). Using Single Molecule and Super-Resolution Microscopy techniques, we could reveal single proton trajectories through the successive activation of fluorescent defects at the surface of the crystal, bringing novel molecular insights on charge dynamics at these interfaces.

The aim of this postdoctoral position is to take advantage of this unique experimental system, to investigate out-of-equilibrium transport processes at the scale of the single interfacial charge. We will combine these single-molecule microscopy techniques with ionic and fluidic transport measurements in micro and nanofluidic devices. This unique combination will allow us to access to the dynamics of single proton charges on the solid surface under out-of-equilibrium fluidic and electric forcings and correlate it with ensemble transport in the channel. We will then extend these strategies to other materials. These measurements at ultimate scales will allow us to gain unprecedented molecular-scale insights on charge transport processes at flowing, electrically driven and confined solid/liquid interfaces.



References

Science Advances (2021), **7***(40)*, eabg8568. (https://doi.org/10.1126/sciadv.abg8568)
Nature Nanotechnology (2020), **15***(7)*, 598-604. (https://doi.org/10.1038/s41565-020-0695-4)

Keywords and Recruitment terms

Single Molecule Fluorescence Microscopy, Super-Resolution, Micro and Nano-Fluidics, Electro-kinetics, 2D-materials, Solid/Liquid Interfaces.

We are looking for a strongly motivated experimentalist, with a background in one of the following domains: Physics, Soft Matter, Optics or Electrochemistry.

The position is initially for one year and renewable. Starting date: From November 2022.

Contact

Please send your applications by email to Jean Comtet (jean.comtet@espci.fr).
Laboratory for Soft Matter and Engineering - ESPCI
10, Rue Vauquelin, 75005 Paris, France