

Post-doctoral position

Direct Ink Writing of High-Density Energy Storage Capacitors

Context and objective:

This project explores an **efficient energy storage solution** based on an **eco-compatible material**. Unlike printed batteries, dielectric capacitors store energy through polarization of dielectric materials. They provide an energy storage approach with intrinsically high power densities (\sim MW/kg). Nevertheless, commercial printable dielectric materials have low energy densities. Moreover, most of the inks are formulated by randomly mixing dielectric spherical nanoparticles with polymers in organic solvents. Printing macroscopically ordered dielectrics remains challenging due to the lack of effective pathways to pattern the nanoparticles into macroscale materials. A thorough understanding of the ordering behavior and the governing phenomena during the out-of-equilibrium printing process and over length scales spanning from nano to macro is still missing. In this project, we will overcome these barriers and fill the knowledge gap by proposing **a new class of water-based composite inks** comprised of polymer and liquid crystalline nanosheets. In contrast to conventional processes and isotropic inks, this concept can lead to higher energy density by generating stronger polarizations at higher fields due to the macroscopic alignment of liquid crystal domains of the nanosheets during 3D printing.

Keywords:

Direct ink writing, Energy storage, Electronic inks, Dielectrics, Liquid crystals

Candidate profile:

We are looking for a highly motivated candidate with experience in ink formulation, inkjet printing or direct ink writing, and electrical characterizations of printed devices.

The candidate holds a PhD in the field of Physical Chemistry of Soft Matter or Functional Materials and obtained his/her PhD within the last two years.

Hosting laboratory:

This is a collaborative project between LCMCP at Sorbonne University (Paris 5), focusing on 3D printing and characterizing dielectric materials, and LPS at Université Paris Saclay (Orsay), specializing in the formulation of liquid crystal inks.

Post to be filled by 02/09/2024

Post-doctoral grant:

The allocation is from the DIM MaTerRe

<https://www.dim-materre.fr/projets-soutenus/lipesc/>

Gross monthly salary \sim 3000 €



Domaine de Recherche et d'Innovation Majeur



Contact and application procedure:

A CV and a motivation letter, including the contact of 2 persons who recommend the candidate, should be sent by e-mail to

LCMCP, Dr. Jinkai YUAN, jinkai.yuan@sorbonne-universite.fr

LPS, Dr. Patrick Davidson patrick.davidson@universite-paris-saclay.fr