



Postdoctoral position at the UCCS laboratory in Lens

Postdoctoral subject: Contribution of Atomic Force Microscopy techniques to the observation of the microstructure of dry-process lithium-ion battery electrodes

In current lithium-ion battery electrode production, a wet process employing potentially toxic solvents is utilized, resulting in a substantial carbon footprint. Battery research is now shifting towards a "dry approach" through extrusion to create films or filaments (3D printing) for batteries, aiming to reduce environmental impact while enhancing battery quality and performance [1]. However, the microstructure of electrodes is influenced by various parameters, including extrusion temperature, material nature, and form, which, in turn, impact electrochemical performance. The objective is to understand how extrusion parameters and materials affect the microstructure to optimize electrode formulations suitable for both liquid electrolyte and all-polymer batteries.

To achieve this goal, the postdoctoral project will leverage atomic force microscopy (AFM) available at the Unit of Catalysis and Solid-State Chemistry (UCCS, UMR CNRS/UArtois 8181) for nanoscale characterization of electrodes, specifically exploring morphological and physical properties. Local current will be probed to visualize conduction pathways, and mechanical behavior will be investigated for distinguishing and identifying different polymer domains and possible fillers at the nanoscale. The results from AFM analyses will be correlated with transmission electron microscopy (TEM) and scanning electron microscopy (SEM) characterizations, further contributing to a mathematical model with the aim of optimizing experimental extrusion parameters.

This project is part of a collaboration with the Laboratory of Reactivity and Solid-State Chemistry (LRCS, UMR CNRS/UPJV 7314) in Amiens, as part of the CPER MANIFEST program. The electrode materials studied by AFM will be developed by LRCS.

[1] A. Maurel *et al.*, Chemistry of Materials 30(21), 7484-7493 (2018)

Candidate profile & skills:

- PhD in chemistry, physics, materials science, or another closely related field
- Experience in physical properties characterizations with AFM techniques
- Experience in local mechanical characterization by AFM
- Skills and knowledge in material characterizations via electronic microscopy (SEM, TEM)
- Skills and knowledge in battery materials
- High degree of responsibility, independence, and collaborations
- Good presentation skills, excellent written and oral English

Application procedure:

Please send motivation letter and CV to: Dr. Anthony Ferri (anthony.ferri@univ-artois.fr)
Dr. Antonio Da Costa (antonio.dacosta@univ-artois.fr)

Duration: 12 months

START DATE: position available immediately