

2531cs1109

Crystal Growth and Neutron Scattering of Functional Battery Materials

[Back to contents](#)

ProjectID	2531cs1109
Project title	Crystal Growth and Neutron Scattering of Functional Battery Materials
EPSRC theme	Advanced Materials
Principal supervisor name	Robin Perry
Principal supervisor UCL profile website	https://profiles.ucl.ac.uk/39513-robin-perry
Host faculty and host department	Mathematical and Physical Sciences (MAPS) London Centre for Nanotechnology (LCN)
Lead department website	https://www.ucl.ac.uk/mathematical-physical-sciences/london-nano
Department PGR administration email	t.mahjaben@ucl.ac.uk ; lucy.keepking@ucl.ac.uk
Standard or collaborative project	Standard project
Restrictions for candidates applying	Only Home fees candidates can apply

Project summary

Solid-state batteries promise major gains in safety, energy density and lifetime, but their performance is still limited by an incomplete understanding of how ions move through real crystalline materials. Ionic transport is controlled not only by average crystal structure, but by defects, disorder, stoichiometry, phase stability and lattice dynamics - precisely the features that are hardest to quantify and control.

This project will establish a new experimental platform for linking crystal growth, atomic-scale structure and ion dynamics in functional battery materials. The student will synthesise and grow high-quality crystalline electrolytes and electrode materials at the UCL Crystal Growth Laboratory, Harwell, exploiting our new 300-bar gas-pressure laser floating-zone furnace. This capability enables access to growth conditions, oxidation states and volatile chemistries that are difficult or impossible to achieve using conventional methods.

The materials produced will be studied using complementary structural, spectroscopic and transport measurements, including X-ray diffraction, Raman spectroscopy, electrochemical impedance spectroscopy and ionic/electronic transport. Neutron scattering at ISIS will provide the key microscopic information: diffraction and total scattering will reveal average and local structure; quasielastic neutron scattering will probe ion mobility; and inelastic scattering will test how lattice dynamics couple to ionic transport.

The central objective is to move beyond empirical materials optimisation and develop quantitative design rules linking synthesis conditions, defect chemistry, local disorder and lattice dynamics to macroscopic transport. The project will therefore address a fundamental problem in energy materials while creating transferable insight relevant to solid electrolytes, electrodes and other functional ionic conductors.

The work will build directly on the supervisors' existing EPSRC-supported research in functional materials and advanced characterisation, and will exploit the unique concentration of crystal-growth and neutron-scattering capability at Harwell.