



The University of Sydney, Characterisation of Relaxor Ferroelectric Single Crystals in Support of Crystal Growth, Utilisation and Compositional Development

- Exciting opportunity to undertake a PhD project with Professor Julie Cairney at the Australian Centre for Microscopy and Microanalysis
- Located at the Madsen Building, Camperdown Campus, University of Sydney
- Full time 3-year PhD offering a stipend of \$37K p.a.

Project Description:

We are seeking a motivated student to join the group led by Professor Julie Cairney, housed within the Australian Centre for Microscopy and Microanalysis. The student will undertake work on an exciting research project funded by the DMTC entitled “Characterisation of Relaxor Ferroelectric Single Crystals in Support of Crystal Growth, Utilisation and Compositional Development”. The focus of this position will be on developing macroscale and microstructural characterisation methods that give new insights into the unique properties of relaxor ferroelectric single crystals. To undertake this project successfully requires a strong background in materials engineering or microscopy.

Project Context:

Relaxor-ferroelectrics are fascinating next-generation materials, but the mechanism of relaxor-ferroelectricity has been puzzling the scientific community for more than 70 years. This project, performed in partnership with Australian Defence researchers, has a specific interest in understanding how the piezoelectric properties can be applied to underwater sonar applications. Australia has a long-term goal to develop sovereign capability in the manufacture of these exciting materials. For Generation I and II crystals, a significant body of literature exists demonstrating the functional mechanisms. However, practical questions remain for specific as-grown crystals before they can be used by defence. Conditions such as optimal poling processes, mechanical depoling, operational aging, fatigue lifetime and failure mechanisms are just a few examples where further work is needed.

There are many challenges for the characterisation of the structural and microstructural response of relaxor ferroelectric materials. The local structural disorder coupled with the nano-scale domain formation creates a unique multi-length-scale system that requires a range of analytical methods to correctly characterise. Here, combining skills between USyd and collaborators at UNSW, the student will probe the true multi-scale nature of the actuation mechanisms in relaxor ferroelectrics. This will be achieved by utilising a world-class array of advanced microscopy infrastructure, including an aberration corrected transmission electron microscope (the highest resolution microscope available) and in-situ holders that allow direct observations of the microstructure as the sample is exposed to stress, strain or electrical stimuli.

The Research Environment:

The School of Aerospace, Mechanical and Mechatronic Engineering (AMME) is one of Australia's premier engineering schools with an international reputation built on more than 130 years' experience. It is home to some of Australia's most prominent research centres in the fields of aerospace, biomedical, mechanical and mechatronic engineering, including the Australian Centre for Field Robotics (ACFR), the Centre for Robotics and Intelligent Systems (CRIS), the Institute of Biomedical Engineering and Technology (BMET) and the Centre for Advanced Materials and Technology (CAMT).

About You:

The University values courage and creativity; openness and engagement; inclusion and diversity; and respect and integrity. As PhD student, you will work under broad direction and will be expected to utilize your experience, technical expertise, scientific knowledge and training/qualifications to resolve matters that arise across the research laboratory to meet the strategic directions of the project.

As such, we see the importance of recruiting talent aligned to these values and skills and are looking for a person who possesses:

- a Bachelors degree in materials engineering, chemistry, physics, or equivalent; applicants who in their final semester of study and expect to graduate in the near future will also be considered.
- A background or interest in characterisation of functional materials using microscopy techniques.
- Ability to work independently and to communicate effectively with team members.
- An Australian Citizen.

How to Apply:

All applications must be submitted via email to both julie.cairney@sydney.edu.au and matthew.griffith@sydney.edu.au.

In order to apply, please address the following two questions in a separate document in addition to you cover letter (which you attach to your online application):

1. (Half page maximum length): please tell us why you are interested in this position.
2. (Half page maximum length): Please provide an example (e.g., previous project experience, published work etc.) of your previous research experience.



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