

Callaghan Innovation R&D Fellowship Wood-derived graphite for Li-ion batteries

Overview: A fully funded studentship is available to work with Dr. Kim McKelvey at Victoria University of Wellington and CarbonScape (<https://www.carbonscape.com/>). The project will use advanced characterisation techniques to quantify the performance of graphite Li-ion anodes synthesised using CarbonScape's patented thermo-catalytic graphitization process.

Background:

Li-ion batteries power almost all modern mobile devices, and battery performance is key to the advancement of these technologies. CarbonScape, a New Zealand-based company, have developed a new synthesis method to form high-quality synthetic graphite from widely available biomass char. Interestingly, the properties of the synthetic graphite can be tailored through optimisation of the synthesis process. However, a detailed understanding of how the synthesis process effects the performance of the synthetic graphite as a Li-ion anode is needed.

Project:

Aim:

- Measure the performance of CarbonScape's synthetic graphite as an Li-ion anode and understand how the graphite synthesis process influences anode performance.

Work to be done:

- Fabricate anodes, using CarbonScape's synthetic graphite.
- Characterisation of anode composition and structure (including electron microscopy, FEGSEM, AFM, X-ray diffraction, etc).
- Electrochemical testing of anodes performance.
- Sensitivity analysis to identify key control parameters.
- Finite element simulations (detailing the mass transport, Li-ion insertion kinetics, side reactions, and electrical resistance effects) to rationalise the measured Li-ion insertion response.

Outcomes:

- Quantify performance of synthetic graphite as a Li-ion anode.
- Identify key parameters in the synthesis method that control the anode performance.
- Identify optimal graphite structure, and the synthesis conditions needed to achieve this.

Research environment:

You will work in a close collaboration with both Dr. Kim McKelvey and CarbonScape. You will be part of a supportive research group in the School of Chemical and Physical Sciences (<http://www.mckelveylab.com/>), as well as the research effort of Blenheim-based CarbonScape. Research will be primarily undertaken at Victoria University of Wellington's Kelburn campus, with samples synthesised at CarbonScape's test facility in Blenheim. The School of Chemical and Physical Sciences at Victoria University of Wellington offers a vibrant research community with world class research facilities. You will have opportunities to interact with other research groups within Victoria, New Zealand, and internationally. You will have the opportunity to attend and present at national and international conferences.

Requirements:

Good degree (4-year BSc (1st or 2:1 honours), MSc, or postgraduate diploma) in Chemistry, Physics, Nanoscience, or related subject. You must be highly motivated and able to work as part of a team. An interest in electrochemistry and battery technology is required. Full training will be given in all aspects of the project.

Application:

For further information or to apply please email a cover letter and CV to kim.mckelvey@vuw.ac.nz