



Capability Statement

Energy Storage Technologies

About us

Our team at the Institute for Frontier Materials (IFM), Deakin University are world leaders in battery technology and electrochemical devices. We have pioneered the design of safer, high performance electrolytes for a range of electrochemical devices.

Our group is composed of highly-skilled researchers in chemistry, electrochemistry, modelling, device engineering and spectroscopy.

Core Competencies

Advanced electrolytes for energy storage

We specialise in the synthesis of electrolytes that are intrinsically safer than commercial molecular solvent-based electrolytes.

Our primary research focuses on the following electrolytes:

- > **Liquid:** Ionic liquid and hybrid electrolytes
- > **Solid:** Plastic crystals and composites, iongels, polymeric electrolytes.

These electrolytes are used in a range of energy storage technologies described below:

Li-based and Na-based batteries

Light active materials, such as lithium (Li) and sodium (Na), are essential to realise high energy density batteries with increased cycle time and performance. This research includes development of a range of new ionic electrolytes with novel cations, anions and salt compositions.

Metal air batteries

This research area focuses on technologies with higher energy density, such as sodium, magnesium and zinc-air batteries. The use of oxygen as an active material is highly advantageous for achieving sustainability of energy storage devices.

Our team also works on other promising emerging technologies, such as miniaturisation of redox flow batteries and metal sulphur batteries.

Circular Economy Focus

Our work in energy materials for a circular economy is focused on:

1. Re-design of batteries for increased safety and ease of critical component recovery
2. Re-purposing of batteries for next life and other innovative applications
3. Recycling and recovery of valuable metals.

Differentiators

Breadth and depth

Our team has the ability to design, synthesise, characterise and prototype electrolytes for energy storage, and our broad research expertise ranges from computational modelling, through chemical design and synthesis, to device prototyping.

Unique electrolyte understanding

The IFM team has a deep and fundamental understanding of electrolyte chemistry and its impact on battery performance. This is critical to understanding the most effective means for separation and electrodeposition for critical component recovery.

Prototyping facilities

We have a unique, world-class research and innovation centre at the Battery Technology Research and Innovation Hub (BaTRI-hub) in Geelong, which drives translation of research into new commercial technologies by:

- Prototyping and testing new electrolyte materials, advanced battery technologies and energy storage solutions focused on safety and energy density
- Prototyping materials from sustainable sources and secondary materials for testing in devices.

State of the art facilities

The Institute for Frontier Materials at Deakin University is equipped with new, world-class electrochemistry and in situ NMR imaging facilities. Facilities for characterisation of air sensitive samples are also available, with state of the art surface characterisation including scanning electron microscopy (SEM), EDX, and FTIR-ATR.

Research Leader

Professor Maria Forsyth

 ifm.deakin.edu.au

 c.mcmahon@deakin.edu.au

 +61 3 5227 3066

 Deakin University 75 Pigdons Road Waurin Ponds VIC 3216, Australia



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