



## Capability Statement

# Membrane Materials in Energy Applications

### About us

**Our team at the Institute for Frontier Materials (IFM), Deakin University leads the research in membrane technology and its applications for energy conversion and resource recovery.**

Our focus is on novel applications of new membrane materials and processes that deliver high performance and are cost-effective for resource recovery and waste to energy conversion.

Our group is composed of highly skilled researchers in materials engineering, chemical engineering, environmental engineering, energy and chemistry.

### Core Competencies

#### Advanced membrane technology for resources recovery and energy/cost reduction in carbon capture

We specialise in the development of innovative new membranes and processes that enable recovery, reuse and recycling of water vapour, waste heat and other valuable resources from various sources, as well as closing the CO<sub>2</sub> loop in biogas production.

Our team has also developed novel membranes and processes to minimise the energy and cost in post-combustion carbon capture and membrane distillation.

#### New high performance, environmental benign catalysts for energy conversion

We have developed novel nanostructured carbon and metal oxide membrane materials and functionalised these materials to improve the conversion of CO<sub>2</sub> to chemicals and fuels.

#### Circular Economy Focus

Our work in energy materials for a circular economy focuses on three main pillars:

- > Engineering new membrane materials for resource (e.g. water, heat and ammonia) recovery from various sources, such as air, power station flue gas and renewable bio-based sources
- > Developing novel membranes for electrolysis that will be used for hydrogen generation with increased efficiency
- > Designing new catalysts (e.g. enzymes and metal organic frameworks) for energy conversion, turning greenhouse gas CO<sub>2</sub> into fuels

### Differentiators

#### Breadth and depth

Our team has the ability to design, fabricate, characterise and apply various membranes and catalysts for resource recovery and energy conversion. Our broad research expertise ranges from materials design from atomic and molecular levels through molecular dynamics and computational modelling, synthesis of micro- and nano-structured porous materials, to their innovative applications.

#### Worldwide institutional and industrial partners

We have a range of institutional and industrial partners working on several projects that are related to resources recovery, reuse and recycling, and energy conversion and reduction that complement our team's capabilities to deliver ground breaking outcomes in research.

#### State of the art facilities

IFM at Deakin University is equipped with world-class material fabrication and characterisation facilities, such as SEM, EDX, and FTIR-ATR. This also includes infrastructure for membrane fabrication, characterisation and test facilities, including atom layer deposition equipment, electrospinning, water contact angle measurement, water permeability test and membrane distillation test equipment.

### Research Leaders

**Professor Lingxue Kong**