High throughput discovery of novel homogeneous catalyst materials for fuel cells

At a glance

ACAL Energy has developed a liquid regenerating fuel cell technology which replaces the conventional platinum catalyst on the cathode electrode with homogeneous polyoxometalate (POM) materials to produce electricity from hydrogen fuel.

Seventy experimental arrays, based on 500 materials, generated a number of exciting candidates for ongoing development – and yielded a number of additional insights.

Challenge

To produce new and improved catalyst materials for use in new fuel cell technology.

Approach

A collaborative research project, part funded by the Technology Strategy Board, was initiated to discover new and improved catalyst materials and develop insights into their synthesis, testing and performance characteristics.

Solution

As part of a collaboration involving ACAL Energy, Thomas Swan and the Universities of Liverpool and Newcastle, Centre for Materials Discovery (CMD) researchers supported the transfer of existing synthetic methods for the production of POM materials onto the automated chemistry platforms available in our laboratories and evaluated their performance.

Working alongside ACAL researchers, a range of synthetic and compositional modifications were introduced to produce multiple arrays of potential new catalysts.

Multiple analytical techniques were used to characterise the new materials and screen their performance as redox catalysts, including NMR, electrospray ionisation mass spectrometry and a kinetic UV screen developed specifically for this project.

Over 500 materials were produced and evaluated across 70 experimental arrays.

Benefits

The experimental arrays generated a number of exciting candidates for ongoing development by ACAL .

Additionally, the high throughput experimental approach yielded insights which would not have come to light using traditional approaches and which will continue to bring benefit to the company. A sponsored PhD studentship has been established at Liverpool to continue research into these materials.