Scientists create cheap and safe electro-catalysts for fuel cells

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Scientists from the University of Surrey have produced non-metal electrocatalysts for fuel cells that could pave the way for production of low-cost, environmentally friendly energy generation.

In a study published in the *Journal of Power Sources*, the team from Surrey worked with colleagues from Queen Mary University of London to create low-cost carbon based electro-catalysts for anion exchange membrane fuel cells. The catalyst helped to achieve a power density performance of 703 watts per square centimetre squared (mW cm^{-2}) from the fuel cells – this compares to a performance of just 50 mW cm^{-2} from previous studies in this area.

The catalysts were made by using a cheap clay material called Halloysite as the template, urea as the nitrogen source and furfural (an organic chemical that can be produced from oats, wheat bran or sawdust) as the carbon source. This was then processed into a fine black powder and used as nitrogen-doped carbon electro-catalyst.

The project was supported by the Engineering and Physical Sciences Research Council's SUPERGEN Hydrogen and Fuel Cell Hub.

Fuel cells are currently used as a low carbon energy technology for electricity generation in transportation and stationary applications, but the use of precious-metal-based catalysts, especially platinum, makes the technology expensive and less sustainable.

Dr Qiong Cai, Senior Lecturer at the University of Surrey, said: "We are delighted with the results of our non-metal electro-catalysts, which shows what can be achieved with such low-cost carbon materials. We could only achieve this via collaborations with Prof Magdalena Titirici (Professor in Sustainable Materials Chemistry at QMUL) who provided advice in material synthesis, and Professor John Varcoe's team (Professor of Materials Chemistry at the University of Surrey) who provided the high-performance anion-exchange membranes and ionomers and supported the test of these materials in the anion-exchange membrane fuel cells.

"We believe that more work needs to be done, but our work demonstrates that low cost catalysts can give high performances in fuel cells and can help reduce the impact of climate change on our planet."

More information: Yaxiang Lu et al. Halloysite-derived nitrogen doped carbon electrocatalysts for anion exchange membrane fuel cells, *Journal of Power Sources* (2017). DOI: 10.1016/j.jpowsour.2017.10.037

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