

*FULLY FUNDED PhD Studentship*

*Starting Oct. 2017*

## **Sensing water accumulation and transport in proton exchange membrane fuel cell with terahertz radiation**

*“Using an emerging technique to address one of the most challenging engineering problems for PEM fuel cells. Hydration and water accumulation will be visualised non-invasively allowing the impact of operational parameters and flow domain design to be assessed.”*

**The Department of Engineering at Lancaster University is pleased to announce the availability of a fully funded PhD studentship in Chemical Engineering**

Proton exchange membrane (PEM) fuel cells are important because of their potential to efficiently produce clean energy from hydrogen. Balanced water management and membrane hydration are critical for optimum fuel cell performance and durability. For example, when the generated water cannot be efficiently removed from the flow channel, flooding results and starves cell regions leading to reduced cell output. In contrast, membrane dehydration reduces load output leading to eventual material damage. Current techniques on water visualisation such as NMR, X-ray and neutron imaging are promising but are expensive and not readily available. The ability of terahertz (THz) radiation to penetrate through some packaging materials and the image contrast achieved by water absorption and refractive index change to the surrounding medium motivates investigation with THz imaging. This project will explore different fuel cell designs to allow THz sensing of the local membrane hydration, demonstrate in-situ THz measurement, and benchmark against humidity readings from humidity sensors as well as possible NMR measurements of the fuel operating under controlled conditions of temperature, gas flow and humidity. The visualisation in turn is useful to provide feedback on the gas flow channel design under the operational influences of temperature, gas flow and humidity to enhance operational understanding of fuel cells while evidencing the potential of THz sensing as a tool for online monitoring.

To be eligible for the studentship, the funding requirements are that you must either be a U.K. citizen or a European Union national. The stipend for eligible students would be £14,296 for 2016/17 and subject to national adjustments.

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