Investigating smart materials and polymer systems for use in conventional, future, and ruggedized Li and Na-ion batteries

PhD

**Funding:** UK/EU nationals for 3.5 years
**Supervisors:** Dr Melanie Loveridge, Dr Rohit Bhagat
**Industrial sponsor:** HMGCC
**Start date:** October 2016

**Project overview:**
HMGCC is an organisation focused on ensuring UK Government communications are highly effective, completely reliable and totally secure. As such, the Power Sources Centre (PSC) within HMGCC has a remit to research, develop and manufacture battery technology for a wide range of applications.

The majority of conventional Li-ion batteries incorporate rigid continuous electrodes and organic electrolyte solutions. These traditional structures function well in everyday applications but may become performance limiting when used in extreme environments. HMGCC is interested in developing novel technologies to improve Li-ion/polymer battery performance in extreme conditions.

For example, freestanding electrodes with high intrinsic electron conductivity may perform better than conventional electrode/current collector laminates under severe vibration or shock. Smarter ways of introducing ionically/electrically-conducting polymer systems within electrodes and electrolytes may lead to battery structures less prone to performance degradation due to cracking or de-lamination when subjected to physical stress or strain.

The problems outlined above will be addressed through this PhD, and you will have full access to the cutting-edge facilities in WMG’s Energy Innovation Centre in order to deliver the research. This includes a battery research, testing, and manufacturing facility. This allows effective integration of the basic and applied research around materials, manufacture, and assembly and characterisation, of both lithium and sodium-ion pouch cells.

**Objectives**
- Development of smart polymer systems for high capacity/high rate electrodes that have self-healing chemistry capability, and demonstrate stable performance and resistance to physical degradation.
- Evaluate ionically conducting polymers to incorporate into or surface-coat electrodes to form continuous networks with electrolytes.
- Identify electro-active polymers that have voltage stability and improve rate performance in cells.
- Deliver prototype-scale cells incorporating key improvements in each area.

**Funding:**
This position provides a tax free stipend for UK/EU nationals of £14,000 plus £3,000 industrial top up, per annum, and all fees paid are paid for up to 3.5 years.
Eligibility:
Applicants should also have a 1st or upper 2nd class honours degree in a related subject, such as materials/polymer chemistry, organic or general inorganic/physical chemistry.

Experience of battery testing would be advantageous but not essential.

Application Details:
To apply please complete our online enquiry form