NECEM SEMINAR: "Metal coordination compounds in electrochemical energy storage"

Tuesday 18th February 2020, 2-3pm

Newcastle University, Armstrong Building, Lecture theatre 2.16

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Redox flow batteries (RFBs) are an established energy storage technology uniquely suited for renewable energy storage and grid-scale energy management due to their decoupled capacity and power. They are versatile devices that can be manufactured to any desired scale, with chemically stable systems theoretically offering unlimited lifetimes. The state-of-art vanadium RFB (VRFB) has been successfully commercialised and demonstrated at scale but techno-economic limitations still remain for VRFB technology.

An intrinsic advantage of RFBs is that the battery architecture can be easily adapted to accommodate a plethora of possible redox materials and electrolytes. One area of interest is the application of non-aqueous (NA) electrolytes which offer a larger design space for redox material exploration. Numerous metal-coordination compounds [1] and redox-active organic molecules [2] have been applied in NA electrolyte which have demonstrated excellent properties, but it is still an emerging field.

In this presentation I will overview two research projects relating to metal coordination compounds used as potential NARFB redox mediators. [3,4] The focus will be on the ligands as a strategy towards rationally designed battery electrolytes with tuneable properties.

References:

[1] RW Hogue, KE Toghill, *Current Opinion in Electrochemistry*, **2019**, 18, 37-45

[2] CG Armstrong, KE Toghill, *Electrochemistry Communications* **2018**, 91, 19-24

[3] RW Hogue, CG Armstrong, KE Toghill, *ChemSusChem* **2019**, 12 (19), 4506-4515

[4] CG Armstrong, KE Toghill, *Journal of Power Sources*, **2017**, 349, 121-129

Research Overview

Finding a way to implement a long-term and sustainable global energy economy is a key challenge of the 21st century. Renewable energy sources have advanced tremendously in the past 10 years, but these developments are fundamentally limited by a lack of suitable storage systems for intermittent energy. My research aims to further harness intermittent wind and solar power by developing flexible, low-cost electrochemical energy storage systems (i.e. redox flow batteries), and explore electrochemical CO_2 reduction to synthetic fuels. My focus is on using low cost, environmentally friendly materials that have real world, long-term potential as viable energy carriers in the future global energy network.

Location

Newcastle University, Armstrong Building, Lecture theatre 2.16

Refreshments available after the seminar from 3pm in the Faraday Room. 1st Floor, Bedson Building, Newcastle University,

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