Project Title*:	Aqueous Rechargeable Zinc-based Batteries
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Faculty Research Area (Theme)*:	Advanced materials
School Research Area*:	Energy
Applicable to other Engineering schools/disciplines:	Chemistry, Materials
Abstract*: (Maximum 200 words)	This project aims at developing a multi-electron transfer redox chemistry to cooperate with the Zn/Zn^{2+} species in mild aqueous solutions. By utilizing these two reversible redox couples, the batteries can be fabricated easily in a cathode- and anode-less method. In addition, by optimization of the electrolyte composition and judicious design of the cell structure, the new chemistry can achieve higher reversibility and redox potentials, which can confer the battery superior cycling stability and high discharge voltage.
Research Environment: (Maximum 100 words)	PartCat Group is a leading group in clean energy technologies. We have established broad research strengths from energy conversion to energy storage. We have fully equipped battery and supercapacitor research facilities. This is an active environment where you not only learn science but also establish linkages with world-class leading researchers.
Novelty and Contribution: (Maximum 100 words)	Zinc, a low-cost metal with two-electron redox and low polarizability is expected to provide excellent specific capacity and power. However, the poor rechargeability derived from dendrite formation and other irreversible side reactions prevent the Zn implementation in next-generation secondary batteries. Recently the research focus for Zn-based rechargeable batteries has been shifted from alkaline systems to mild aqueous systems with MnO_2-, V_2O_5- or Prussian blue analogue-based cathodes. However, they are still suffering from limited voltage (~1.4V) and cycling stabilities. This research will pave a way towards a new Zinc chemistry with high-voltage and long-cycle-life as well as easy fabrication.
Expected Outcomes: (Maximum 100 words)	The project aims to develop a novel aqueous Zinc-based rechargeable battery with in situ formed electrodes. This chemistry will tackle the problems of low discharge voltage and poor cycling stability by new redox chemistries. The research will train students in battery fabrication, material characterization and electrochemical testing skills and is expected to lead a publication in a peer-reviewed journal, preparing for future career in industry and/or higher degree research.
Reference Material Links	*ACS Energy Lett.*, **2018**, *3* (10), pp 2480–2501
Wii the student visit the premises of an industry partner, or undertake any activity on premises external to UNSW?*	No