From Lithium Metal Powder to High Energy Electrodes

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Lithium metal has the highest specific gravimetric capacity of all electrode materials for batteries. It remains, largely, an unsolved mystery as to how to control Li plating in 2-dimensions for 100's to 1000's of cycles without the formation of micro-structures and dendrites which cause eventual short circuit and device failure [1]. In order not to deal with the Li metal problem, significant interest has been poured into alternative high capacity anode materials such as silicon (Si) and composites thereof. As our knowledge of Si electrode technology increases, the benefits to energy density within the cell is incremental at best, returning us to the Li metal as a potential solution. However, the cost of Li metal has increased substantially in recent times due to the relative lack of supply and demand for Li precursors elsewhere in the battery value chain.

Li metal is typically manufactured via an electrochemical method from a eutectic mixture of LiC and KCl, however, this process is both expensive and environmentally unfriendly. To address these issues, CSIRO has developed a new technology, LithSonic™, a derivation of MagSonic™, to produce Li metal *powder* via carbothermal reduction reaction [2]. From this powder, we now have the opportunity to prepare Li foils where we have the potential to further engineer interfaces and attempt to control Li dendrites on cycling.

In this presentation we will overview the carbothermal method for the production of Lithium metal and our work on the use of ionic liquid electrolytes to stabilise the metal interface. We will highlight our efforts using *ab* initio molecular dynamics (AIMD) simulations to examine the interaction between IL electrolytes and Li metal [3, 4, 5], which is critical to enable devices such as Li-S, with the goal of developing the next generation of high energy batteries.

References:

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