



2022「中技社科技獎學金」

2022 CTCI Foundation Science and Technology Scholarship

研究獎學金
Research Scholarship



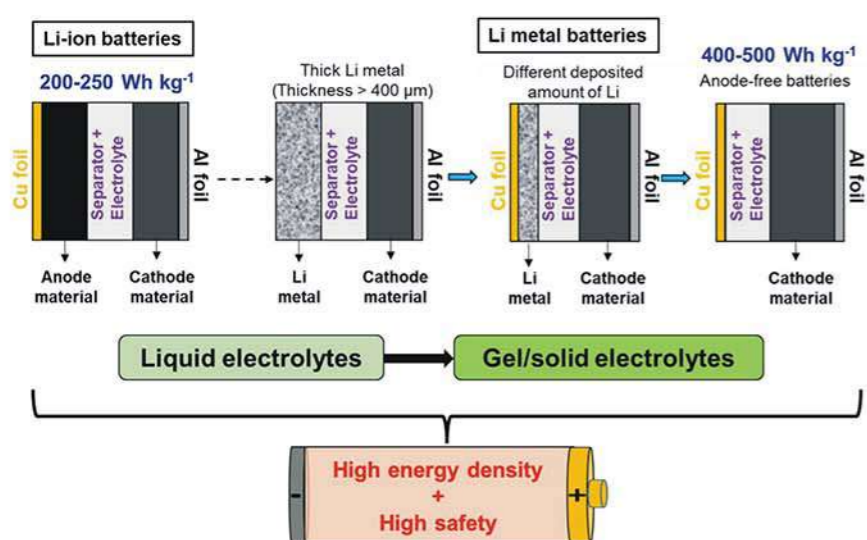
膠態電解質於鋰金屬電池之應用

The Application of Gel Electrolytes for Lithium Metal Batteries

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研究重點

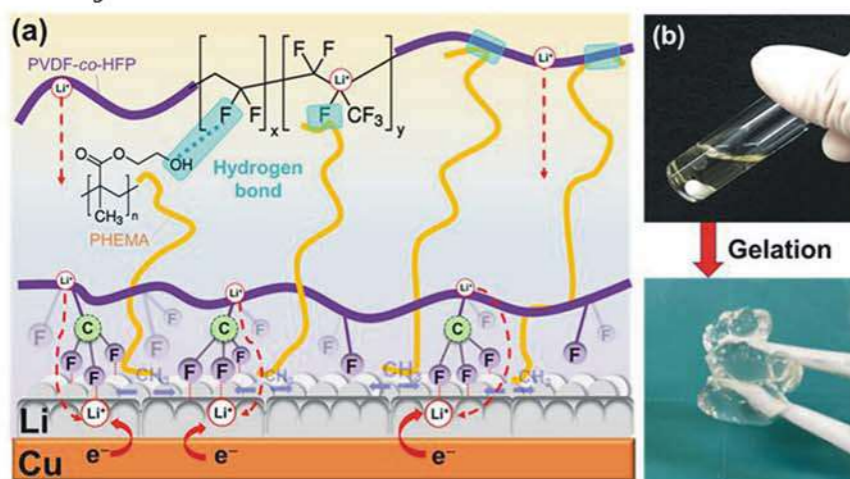


The lithium rechargeable batteries among metal-ion batteries have been viewed as the most promising battery system to achieve high gravimetric/volumetric energy density. However, the current commercial Li-ion batteries meet their theoretical limitations (~250 Wh kg⁻¹). The graphite-based anodes suffer from low theoretical specific capacities (~372 mAh g⁻¹), which limit the energy density of commercial Li-ion batteries. We replaced the graphite-based anode by Li metal anode which has high theoretical specific capacities (~3860 mAh g⁻¹). To address the issues of Li metal anode, for example, lithium anode volume expansion with cycling and the unstable SEI which caused by the highly reactive Li metal and liquid electrolyte, we designed an onsite gel polymer electrolyte (GPE) and used the functional PVDF-based polymer network to regulate the Li ions. The highly stable interface created by the GPE enabled stable cycling performance of lithium metal batteries. Furthermore, we decreased the Li amount on the anode side and constructed a prototype of gel anode free battery which can reach higher energy density. From the SEM images of deposited Li morphology on the Cu and the cycling performance of the different amount Li anode paired with LFP cathode, the GPEs verified its feasibility for practical uses.

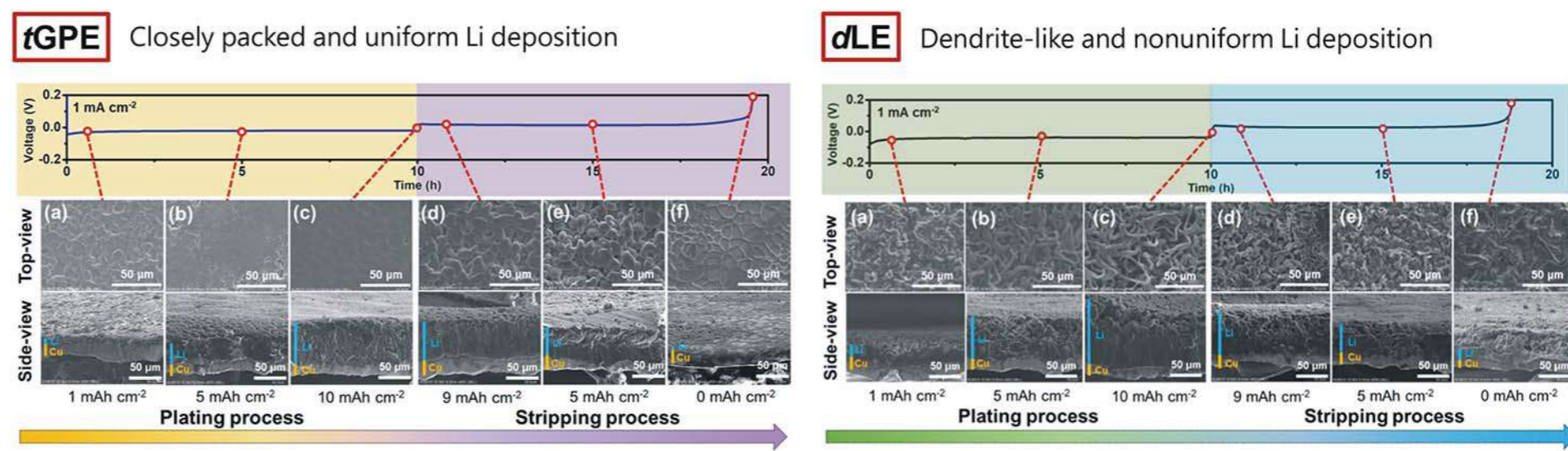
研究成果

1. The Characteristics of gel electrolytes

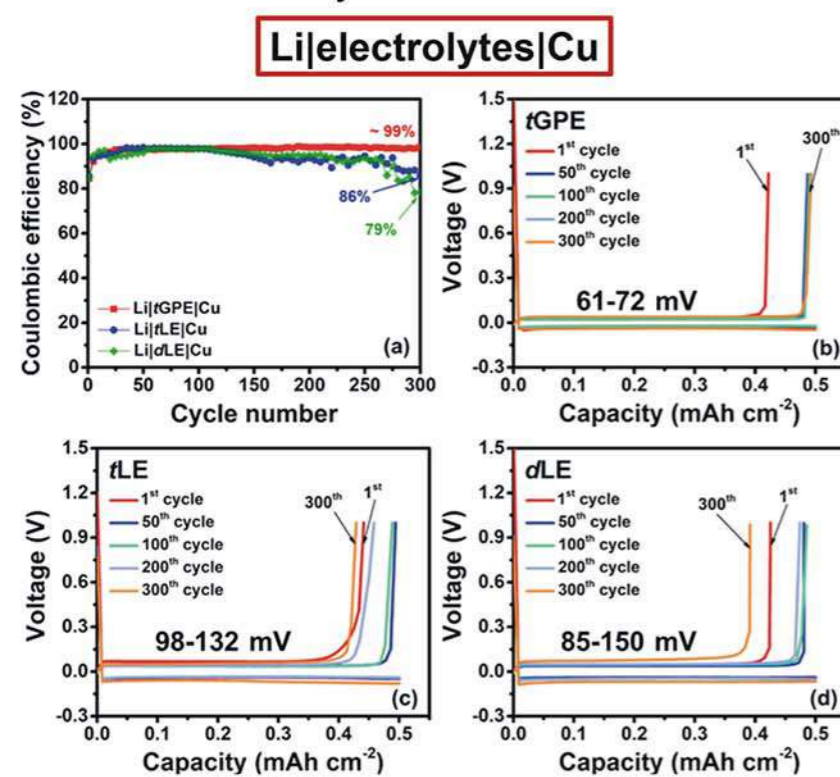
A gel polymer electrolyte (GPE) by using a blend of PVDF-based polymer and Poly(2-hydroxyethyl methacrylate) (PHEMA) to accommodate a solution of LiTFSI, LiPF₆, and LiNO₃ in ether-based solvents.



2. SEM images of the deposited Li morphology on the Cu substrate for GPE and LE

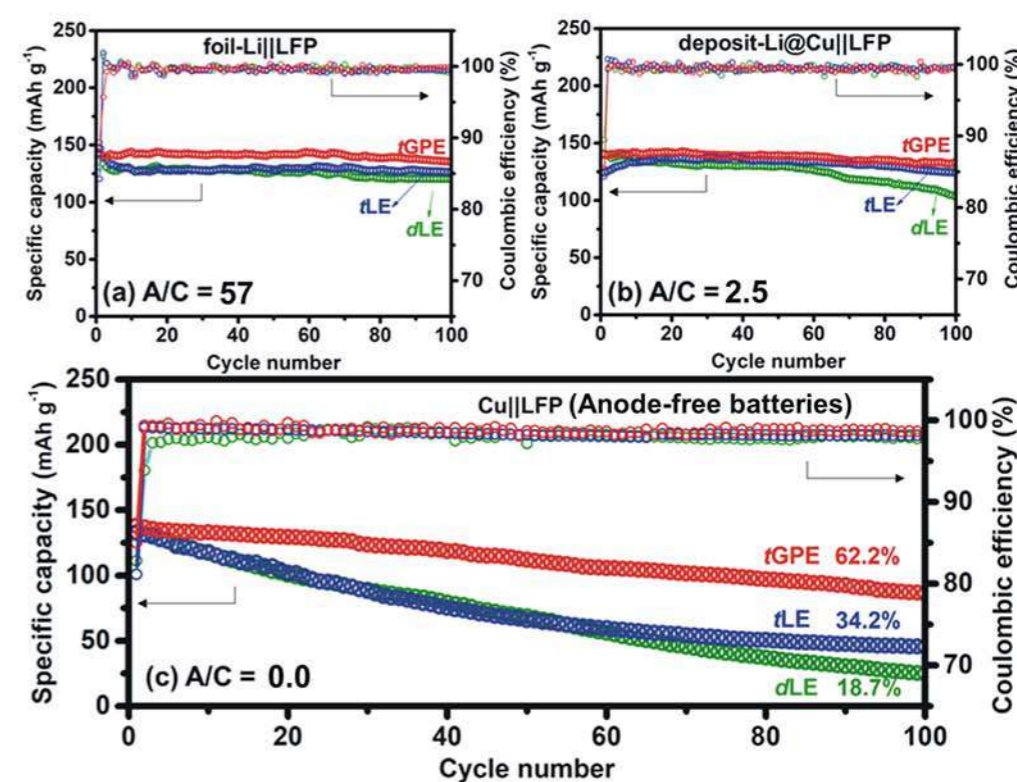


3. The Li reversibility



5. Cycling performance of Li metal batteries

The Li batteries with different A/C ratio (capacity ratio of the anode to cathode) were assembled to explore the ability of the dLE, tLE, and tGPE in maintaining the reversibility of Li plating.



研究生活與心得

首先要感謝中技社委員給予我研究成果上的肯定和系上委員們的推薦，對於我來說是相當大的鼓勵。同時也很感謝我的指導教授鄧熙聖老師，在討論研究進展或是實驗資源的提供，老師都十分的支持，也會適時的給予我一些方向。在博士研究的路上有時候會覺得挫折或是迷茫，但只要時時想著喜歡研究的初心就可以再重新振作，希望自己的研究能夠為幫助這個世界的科技或是生活盡一份心力。最後，謝謝家人們、朋友及實驗室的夥伴給我的鼓勵和幫忙，你們是我強大的後盾。