



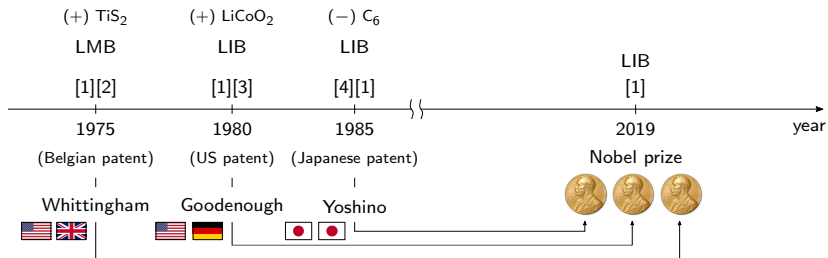
## **Lightning math night 2024: Fantastic clovers and where to find them.**

Tuan Vo

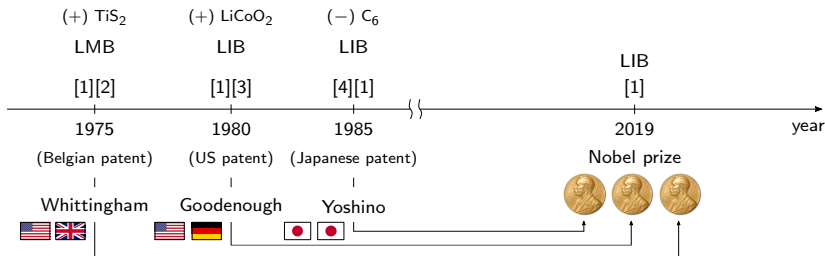
ACoM | RWTH Aachen University

Aachen, 17th January 2024

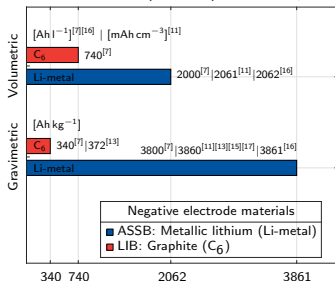
## (i) Once upon a time: Lithium-ion battery (LIB)



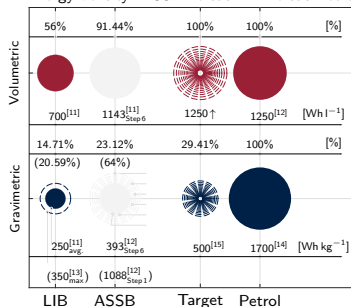
## (i) Then: LIB → limits



Theoretical capacity of charge:  
pure metallic lithium (Li-metal) versus Graphite ( $\text{C}_6$ )

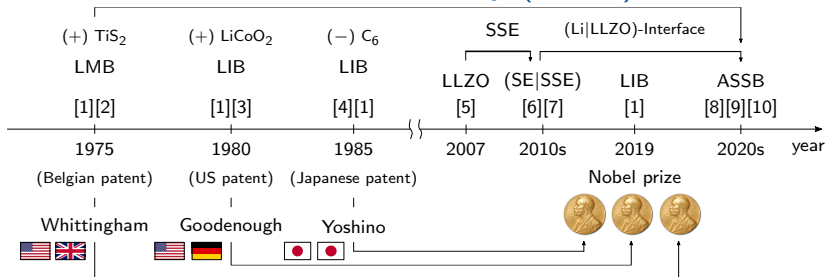


Energy density: ASSB versus LIB versus Petrol

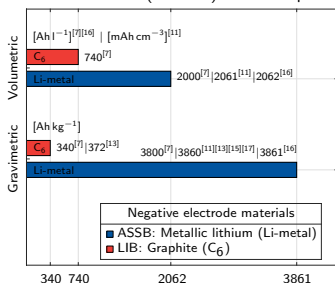


# (i) After that: All-solid-state battery (ASSB)

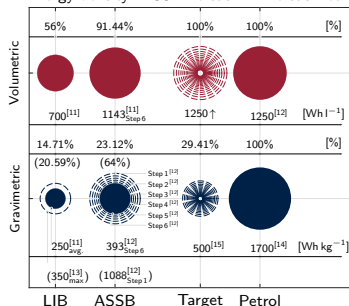
(-) Li-metal



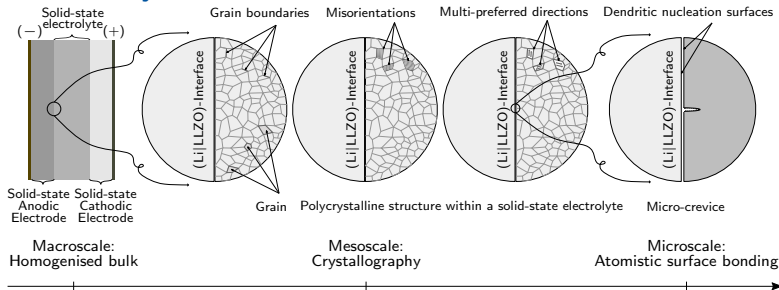
Theoretical capacity of charge:  
pure metallic lithium (Li-metal) versus Graphite ( $\text{C}_6$ )



Energy density: ASSB versus LIB versus Petrol



## (ii) Let's analyse this..



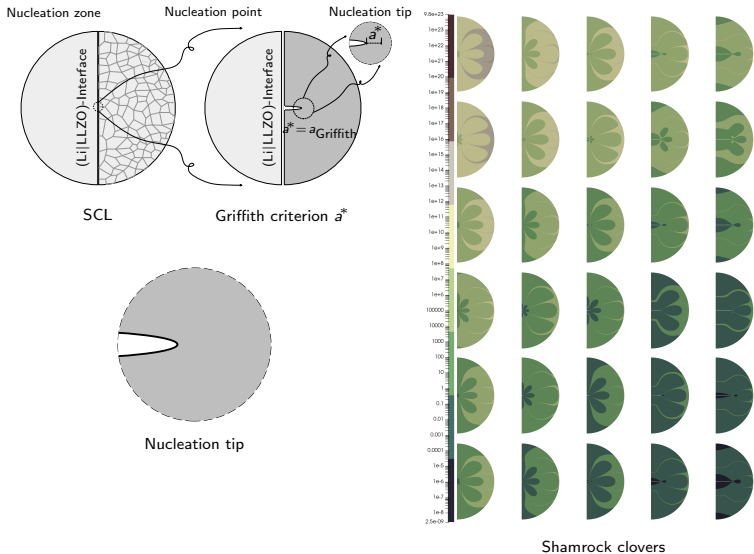
Find  $a$  such that the following optimisation problem  $\forall a \in \mathcal{V}$  hold:

$$\rho \frac{D^2 U}{Dt^2} - \nabla \cdot \left( \mathbb{C}_{(\lambda, \mu)}^{T_f \phi} : \nabla U^{(s)} \right) + \rho \nabla V_E = \mathbf{0}, \quad (1)$$

$$\text{s.t. } a_{\text{Griffith}} := a^* = \arg \inf_{a \in \mathcal{V}} \left\{ \iiint_{\Omega} f(a, \mathbf{u}, \theta, c^m |\text{Li}^+|^n; \lambda, \mu, \mathbf{d}_{G_j} \otimes \mathbf{d}_{G_j}) d\Omega \right.$$

$$\left. - \iint_{\Gamma} f(a; \gamma) d\Gamma \right\} \quad (2)$$

(ii) ..and put it into numerical experiment: Here we go!!



Thank you for your listening!!