

Electronic Supplementary Information

Design principles for LiFePO_4 electrodes with improved recyclability

Lechen Yang,^a Dominika Gastol^a and Emma Kendrick^{*a}

a. School of Metallurgy and Materials, The University of Birmingham, Edgbaston, Birmingham, B15 2SE, UK.

b. E.kendrick@bham.ac.uk.

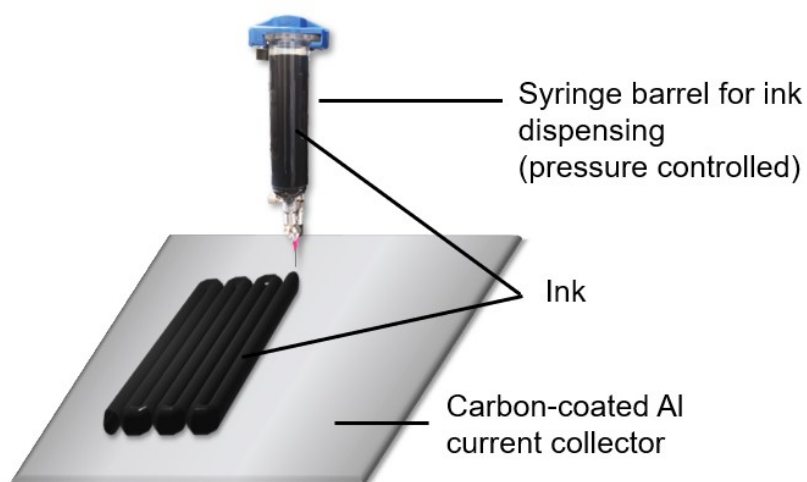
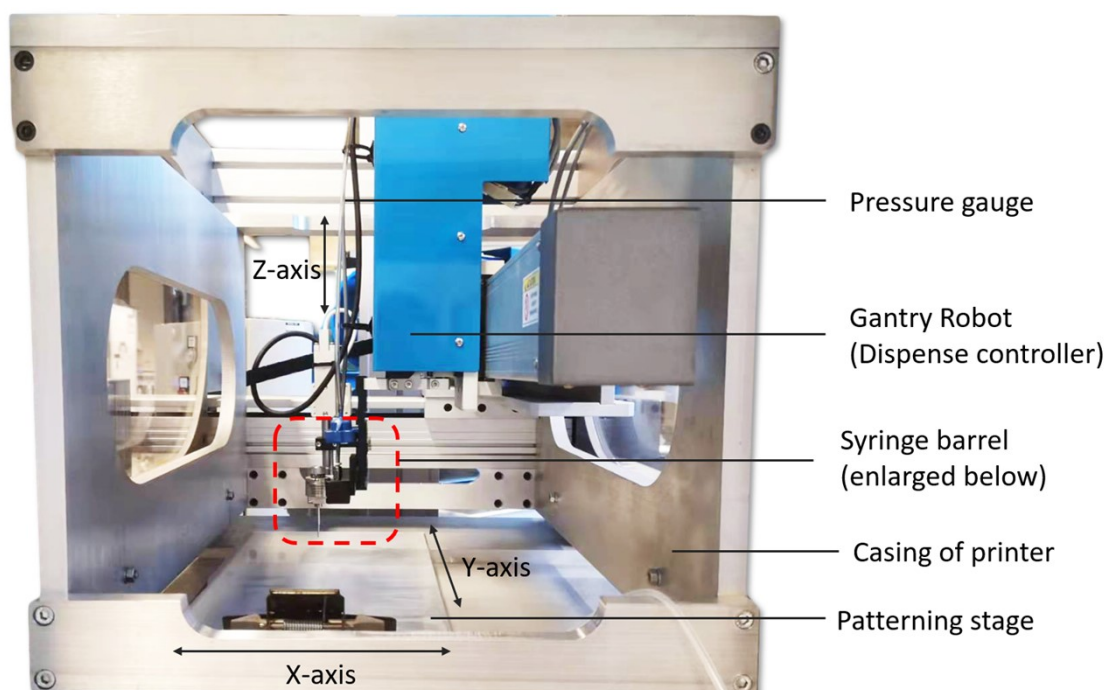


Fig. S1. Schematic diagram of the direct ink writing technique employed in this work. The figure on the top shows an overall view of the printer with process parameters explained in the main text, whereas the figure below shows an insight of the syringe barrel containing inks for the 3D printing process.

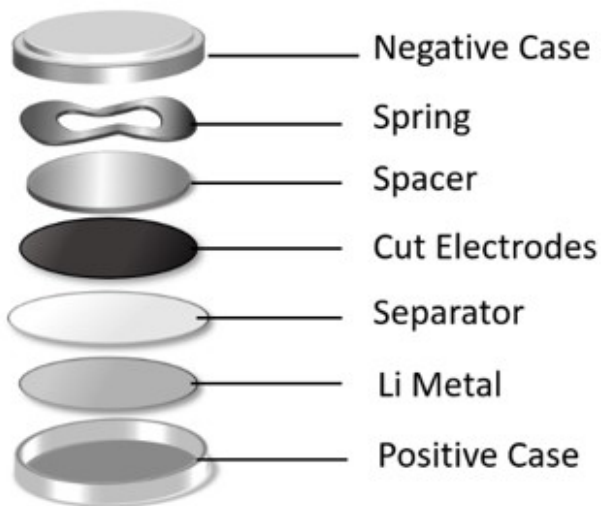


Fig. S2. Schematic diagram showing the construction of coin cells in this work.

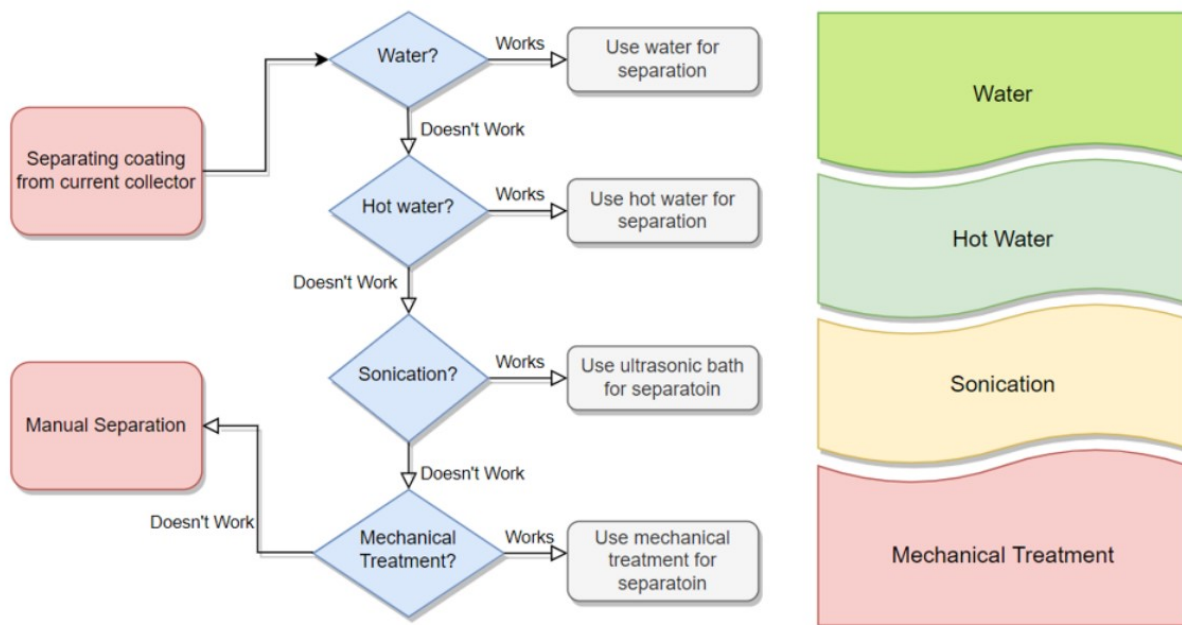


Fig. S3. Flow chart showing the suggested approaches used for electrode delamination for electrodes incorporating aqueous binders that were attempted, ranked from minimal energy requirement approaches (green) to energy intensive approaches (red).

Table S1. Criteria of ERADE assessment matrix.

		0 - 2 (Inclusive)	3 - 5 (Inclusive)
Material Range	Applicable to most types of materials?	No - certain types of materials are unavailable	Yes - applicable to most types of materials, e.g. metals, ceramics
Ink Readiness	No requirement on further ink formulation?	Requirements on ink formulation	No or little requirement on ink formulation
Design Versatility	Ability to produce patterns/construct complex electrode architecture?	No	Yes
	Ink Controllability; Electrode Resolution?	Little (no) ink controllability, low resolution	Excellent ink controllability, high resolution
Economic Viability	Initial Cost of Setup	> £5,000 [1]	≤ £5,000
	Energy consumption	> 1 kWh [1]	≤ 1 kWh
Electrochemistry	Capacity and Rate compared to CMC/SBR DD electrodes (the reference)	Capacity and rate have reduced more than 5% from the reference	Capacity and rate are within 5% difference from the reference or higher
	Tortuosity	Tortuosity for coatings higher than 1	Able to reach a tortuosity of 1 (eg. via channels)
Recyclability	Separation efficiency via water immersion	< 90% within 5 min	≥ 90% within 5 min
	Recovery Rate of Active Material	< 90%	≥ 90%

References:

- [1] GV Series Automated Fluid Dispensing Robot | Gantry Robot | Nordson EFD n.d.
<https://www.nordson.com/en/divisions/efd/products/automated-dispense-systems/gv-series-automated-dispensing-system> (accessed March 29, 2022).