

Supporting Information

Large-scale direct regeneration of $\text{LiFePO}_4@C$ based on spray drying

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Fig. S1. Photograph of (a) spent, (b) homogenized, (c) spray-dried and (d) regenerated LiFePO_4

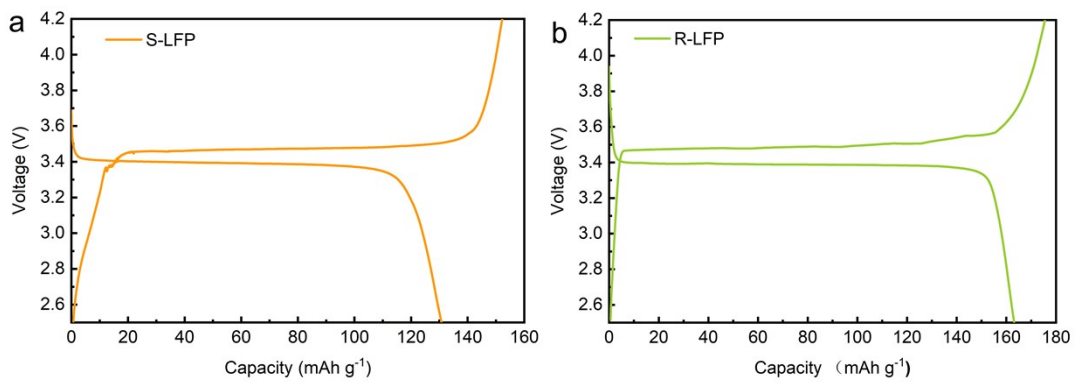


Fig. S2. The first turn charge and discharge curve of (a) S-LFP and (b) R-LFP

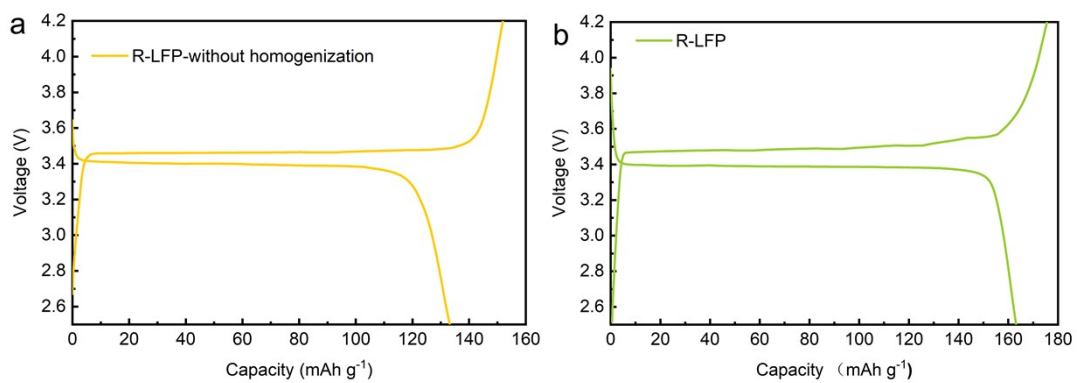


Fig. S3. The first turn charge and discharge curve of (a) R-LFP-without homogenization and (b) R-LFP

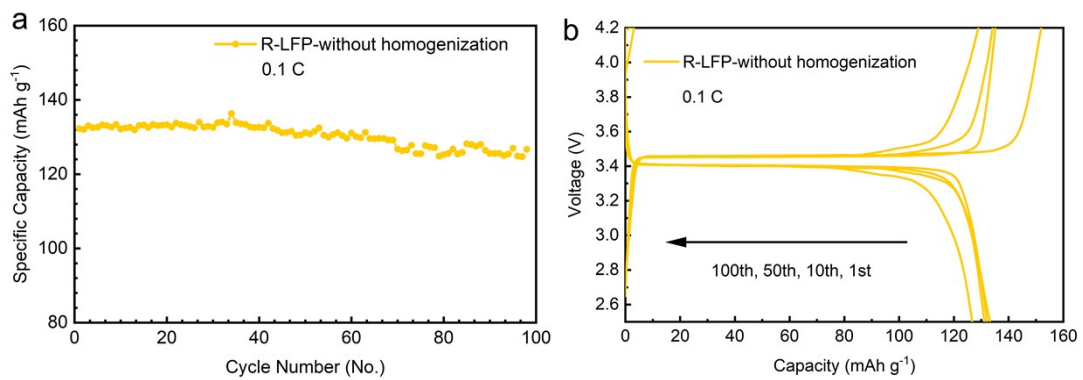


Fig. S4. (a) Charge-discharge curves and (b) Long-term cycling stability of R-LFP without homogenization.

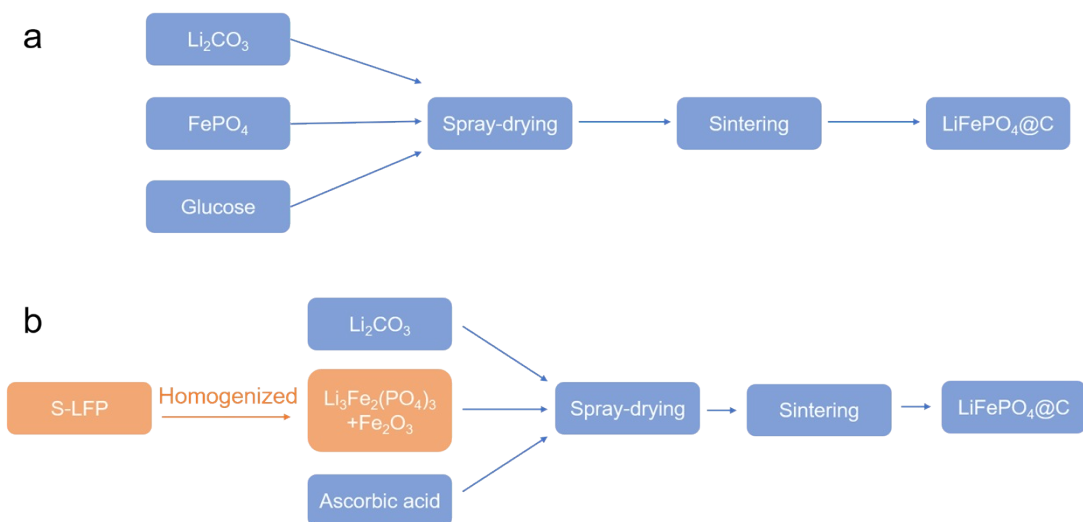


Fig. S5. Process flow diagrams of (a) LFP materials preparation (b) LFP recycling

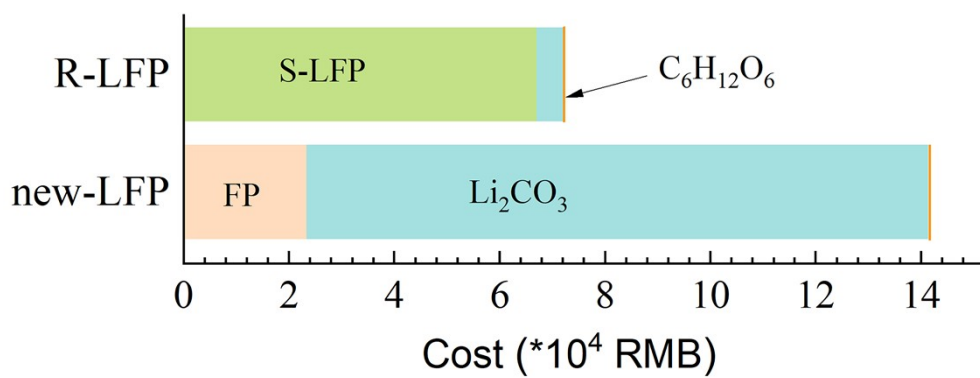


Fig. S6. The cost comparison between R-LFP and solid state synthesis LFP

Table S1

XPS elemental composition

Mass ratio /%	Fe	O	P	C
S-LFP	4.23	32.39	5.34	58.04
Homo-LFP	5.11	38.86	7.34	48.69
R-LFP	1.31	14.61	1.12	82.96

Table S2

ICP-MS results of spent lithium iron phosphate

Elemental types	Mass fraction (wt%)	Amount of substance per kg (mol/kg)
Fe	34.53%	6.183935
Li	4.41%	6.356335
P	15.58%	6.029794

Table S3

The raw materials cost breakdown of R-LFP and solid state synthesis LFP

Raw materials cost of production of 1 ton R-LFP				Raw materials cost of production of 1 ton of LFP via solid state synthesis			
raw materials	unit price (*10 ⁴ yuan)	quantity (ton)	cost (*10 ⁴ yuan)	raw materials	unit price (*10 ⁴ yuan)	quantity (ton)	cost (*10 ⁴ yuan)
S-LFP	6.71	1	6.71	iron phosphate (FP)	2.45	0.956	2.3422
Li ₂ CO ₃	50.5	0.01	0.505	Li ₂ CO ₃	50.5	0.234	11.817
glucose	0.27	0.07	0.0189	glucose	0.27	0.07	0.0189
SUM			7.2339	SUM			14.1781

Economic and Environment Analysis

We have carefully considered the cost of this regeneration method. The current market price of LFP raw material is ¥157,500 per ton, the price of S-LFP black powder is ¥66,100 per ton, the price of lithium carbonate is ¥505,000 per ton, the price of iron phosphate (FP) is ¥24,500 per ton, and the price of food grade glucose is ¥2,700 per ton. To obtain 1 ton of recycled lithium iron phosphate, we need approximately 1t of S-LFP black powder, 0.01t of lithium carbonate, and 0.07t of glucose. After calculation, the cost of regenerating 1t of lithium iron phosphate material is ¥72,339 per ton, which is approximately 51.02% of the marketed LFP. The regeneration process is also close to the current lithium iron phosphate manufacturing process, enabling direct use of existing equipment for production and reducing upfront investment costs, with the potential for industrial production.