All-3D-printed lithium metal batteries with high energy density

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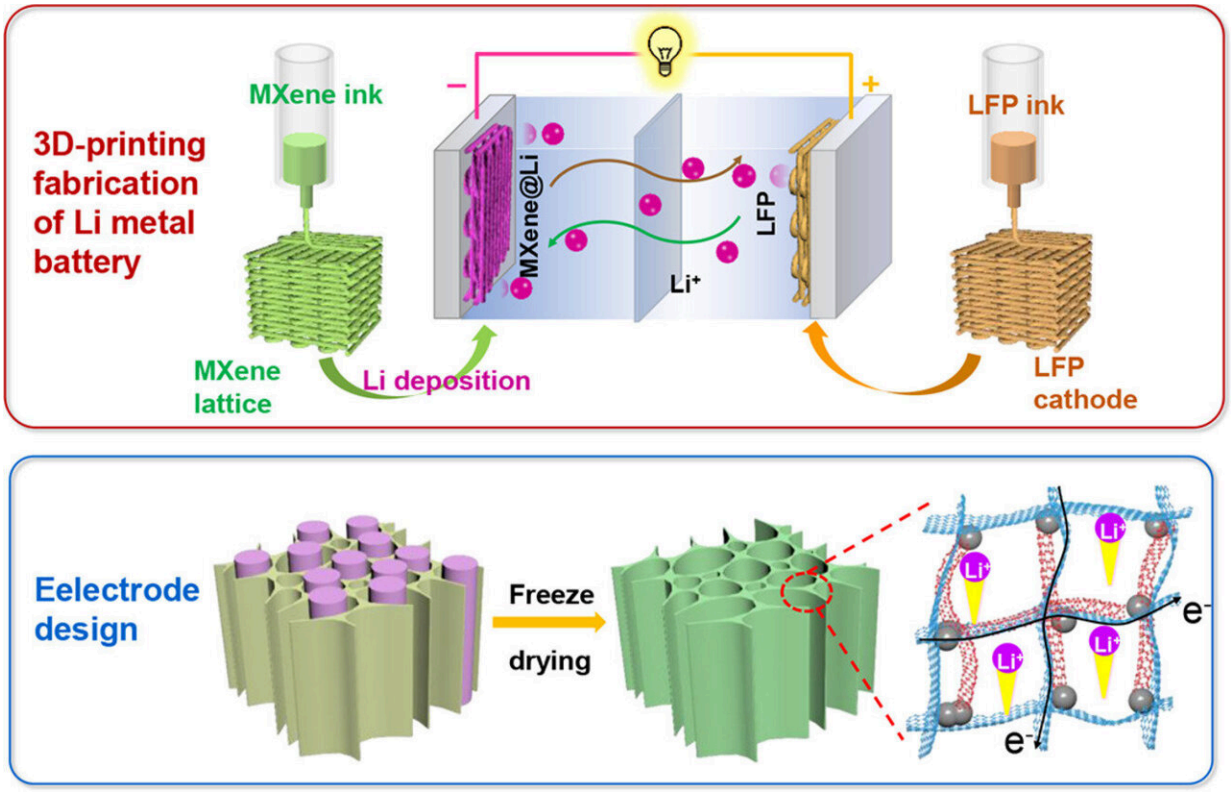

Graphical abstract. Credit: *Energy Storage Materials* (2022). DOI: 10.1016/j.ensm.2022.10.036

A research team led by Prof. Wu Zhongshuai from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences has developed all-3D-printed Li metal batteries (LMBs) with robust cycle

stability and ultrahigh areal energy density.

The LMBs take a porous and conductive $Ti_3C_2T_x$ MXene skeleton for a dendrite-free and stable Li metal anode and multi-dimensionally conductive $LiFePO_4$ (LFP) lattice as the ultra-thick cathode.

This study was published in *Energy Storage Materials* on Oct. 19.

LMBs are considered as a class of high-energy-density systems beyond current state-of-the-art lithium-ion batteries. Nevertheless, the uncontrollable dendrite growth and huge volume change of Li metal anodes have raised poor cycle life issues.

In this study, the researchers reported an all-3D-printing approach for constructing ultrahigh-performance LMBs. The LMBs were comprised of a dendrite-free Li metal anode with porous MXene lattices to regulate local current distribution, which homogenized the lithium nucleation, and a 3D conductive porous LFP framework cathode to achieve fast ion/electron transfer channels.

Due to the abundance of Li nucleation sites and large pore volume in the MXene lattices, the 3D printed MXene scaffolds prevented the infinite volume change and dendritic formation of Li anodes.

Furthermore, by pairing ultra-thick LFP cathodes lattices with high-efficiency electron and ion networks, the all-3D printed LFP||MXene@Li LMBs delivered unprecedented areal capacity (25.3 mAh/cm^2) and energy density (81.6 mWh/cm^2) under an ultrahigh mass loading of 171 mg/cm^2, exceeding all reported 3D printed batteries so far.

More information: Jiaxin Ma et al, All 3D printing lithium metal batteries with hierarchically and conductively porous skeleton for

ultrahigh areal energy density, *Energy Storage Materials* (2022). DOI: 10.1016/j.ensm.2022.10.036

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