



**SolarTech Power Solutions**

# **Bipolar stacked lead-manganese energy storage battery**



## Overview

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The EMBATT technology is a bipolar battery concept developed by Fraunhofer IKTS and partners from the industry with the aim of achieving energy densities of more than 450 Wh/l on the system level based on conventional Li-ion active materials, thus increasing the reach of electric vehicles. The standout feature of the bipolar structure is that both electrodes are applied onto the same distributor foil, which means they can be stacked directly onto one another and electrically wired in series. Can manganese-lead batteries be used for large-scale energy storage?

However, its development has largely been stalled by the issues of high cost, safety and energy density. Here, we report an aqueous manganese-lead battery for large-scale energy storage, which involves the  $\text{MnO}_2/\text{Mn}^{2+}$  redox as the cathode reaction and  $\text{PbSO}_4/\text{Pb}$  redox as the anode reaction.

What is bipolar stacked electrode coupling with solid-state electrolytes?

Bipolar-stacked electrode coupling with solid-state electrolytes enables achieving batteries with high output voltage, high energy density, and simple components.

How much power can a bipolar cell stacked in series achieve?

With 63 cells stacked in series, we show that a bipolar stack could reach a stack voltage up to 265 V. In contrast, a parallel stack with 32 double-coated cells could achieve a nominal capacity of 4 Ah. We also demonstrate that the choice of current collectors is critical in determining the gravimetric power and energy density of both stacks.

Can multilayered bipolar stacking improve energy density?

Multilayered bipolar stacking in ASLBs can further improve the energy density by minimizing the use of inactive materials. However, it is highly challenging to fabricate bipolar stacked ASLBs because of lacking vigorous laminated electrodes and electrolyte, especially for sulfide solid electrolytes.

What is the product of capacity and voltage of a bipolar battery?

To follow, the battery energy is known as the product of capacity and voltage. The capacity of bipolar battery is the same as that of a single unit cell, while the output voltage of bipolar battery is determined by the product of the number of unit cells in series and the voltage of each cell. [ 10 ].

Does bipolar stacked soft-pack battery promote the development of asslbs commercialization?

Remarkably, the bipolar stacked soft-pack battery of LFP-SPE/Li//LFP-SPE/Li is also fabricated and the open circuit voltage is as high as 6.33 V. Consequently, the reported new electrolytes and corresponding cell assembled approach have a significant effect on promoting the development of ASSLBs commercialization.

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