LITHIUM-ION BATTERIES

# Fast charge in cold climates

*Proc. Natl Acad. Sci. USA* **115**, 7266–7271 (2018)

Batteries with significant fast-charge capability can ease range anxiety concerns over electric vehicles (EVs), especially as more and more fast charging stations are now being built. However, the current Li-ion batteries (LIBs) that dominate EV markets generally do not operate well at temperatures below 0 °C. This is largely due to the problem of metallic Li deposition on the graphite anode (typically referred to as Li plating) at low temperatures, which shortens battery life, reduces battery capacity and causes safety hazards. Most efforts to enhance fast-charge capabilities are through the optimization of anode materials or the development of high-performing electrolytes at low temperatures. Now, Chao-Yang Wang and colleagues from the United States and China report an efficient strategy to fast-charge a Li pouch cell at cold temperatures (reaching 80% state-of-charge within 15 min even at –50 °C), by embedding a self-heating material inside the cell.

The lab-made pouch cell features a graphite anode and a $LiNi_{0.6}Mn_{0.2}Co_{0.2}O_2$ cathode. It has an energy density of 170 Wh $kg^{-1}$, which is similar to commercial Li pouch cells. The self-heating material is a thin Ni foil that is coated with an electrical insulator and then attached to the anode. When the ambient temperature is low, a control device allows current to flow through the Ni foil, which generates heat rapidly and warms up the interior of the cell (at a timescale on the order of 1 min). Once the internal cell temperature reaches a certain threshold, the control device will guide the current to the anode, instead of the Ni foil, to activate the charge mode. The researchers show that this approach avoids the troublesome Li plating and enables fast-charge capability at cold temperatures, without suffering the usual capacity loss in cycling.

Changjun Zhang

Published online: 8 August 2018
https://doi.org/10.1038/s41560-018-0225-x