Fast charging of lithium-ion batteries at all temperatures

Fast charging of lithium-ion batteries at all temperatures. / Yang, Xiao Guang; Zhang, Guangsheng; Ge, Shanhai et al. In: Proceedings of the National Academy of Sciences of the United States of America, Vol. 115, No. 28, 10.07.2018, p. 7266-7271. Research output: Contribution to journal > Article > peer-review

We demonstrate a 9.5 Ah 170 Wh/kg LPF cell that can be charged to 80% state of charge in 15 min even at -50 °C (beyond cell operation limit). Further, the LPF cell sustains ...

The self-heated all-climate battery cell yields a discharge/regeneration power of 1,061/1,425 watts per kilogram at a 50 per cent state of charge and at minus 30 degrees Celsius, delivering 6.4 ...

Here, we present an approach that enables 15-min fast charging of Li-ion batteries in any temperatures (even at -50 °C) while still preserving remarkable cycle life (4,500 cycles, equivalent to >12 y and >280,000 miles of EV lifetime), thus making EVs truly weather-independent. ... Fast charging of lithium-ion batteries at all temperatures ...

The self-heated all-climate battery cell yields a discharge/regeneration power of 1,061/1,425 watts per kilogram at a 50 per cent state of charge and at minus 30 degrees Celsius, delivering 6.4-12 ...

The test sample is a commercial 8 Ah pouch lithium-ion battery, with the LiNi 1/3 Mn 1/3 Co 1/3 O 2 (NMC) cathode and graphite anode (Table 1), whose detailed specification refers to Ref. [23].The experimental platform, composes of battery test equipment (MACCOR), a climate chamber, a data acquisition unit, and some T-type thermocouples and the details can be found ...

The internal resistances of LiMnNiO and LiFePO 4 batteries were examined by [19] between 50 °C and - 20 °C.The outcomes demonstrated that the cell resistance was very high at lower temperatures. Charging Li-ion batteries at low temperatures slows down the intercalation of lithium ions into the anodes responsible for lithium-ion deposition on the electrode"s surface in ...

The charging power capability of the cells was assessed with a charge rate map at three different temperatures: 23 °C, 5 °C, and -10 °C. The map consisted on single cycles between 2.5 V and 4.2 V using a CCCV charging protocol (constant current-constant voltage, with termination when the current reached the limit of 3 mA) with progressive increase in rate ...

Fast charging is considered to be a key requirement for widespread economic success of electric vehicles. Current lithium-ion batteries (LIBs) offer high energy density enabling sufficient driving range, but take considerably longer to recharge than traditional vehicles.

Electric vehicles (EVs) in severe cold regions face the real demand for fast charging under low temperatures,

but low-temperature environments with high C-rate fast charging can lead to severe lithium plating of the anode material, resulting in rapid degradation of the lithium-ion battery (LIB). In this paper, by constructing an electrode-thermal model ...

Here, we present an ap-proach that enables 15-min fast charging of Li-ion batteries in any temperatures (even at 50 °C) while still preserv-- ing remarkable cycle life (4,500 cycles, ...

Previous studies have made much effort to solve these problems. Improving the performances of electrode materials in low-temperature conditions is an effective solution [19], [20], [21], but the advanced materials usually introduce additional costs.Regulating the charging protocol is lower-cost to realize low-temperature fast charging, and these methods apply to ...

This work presents an approach that enables 15-min fast charging of Li-ion batteries in any temperatures (even at -50 °C) while still preserving remarkable cycle life (4,500 cycles, equivalent to >12 y and >280,000 miles of EV lifetime), thus making EVs truly weather-independent. Significance Range anxiety is a key reason that consumers are reluctant to ...

The correct specification charger is critical for optimal performance and safety when charging Li-Ion battery packs. Your charger should match the voltage output and current rating of your specific battery type. Lithium batteries are sensitive to overcharging and undercharging, so it is essential to choose a compatible charger to avoid any ...

A significant barrier to the mass adoption of electric vehicles is the long charge time (& gt;30 min) of high-energy Li-ion batteries. Here, the authors propose a practical solution to enable fast ...

None of today"s EVs can withstand fast charging in cold or even cool temperatures due to the risk of lithium platin... Fast charging is a key enabler of mainstream adoption of electric vehicles (EVs).

Fast charging of lithium-ion batteries at all temperatures Xiao-Guang Yanga, Guangsheng Zhanga, Shanhai Gea, and Chao-Yang Wanga,b,c,1 aElectrochemical Engine Center, Department of Mechanical and ...

Experiments proved that the method could shorten charge time and prolong cycle life compared to a 1C constant current - constant voltage (CC-CV) protocol. Overall, much remains to be studied regarding mechanical degradation in Li-ion batteries under fast charging conditions.

Efforts to enable fast charging are hampered by the trade-off nature of a lithium-ion battery: Improving low-temperature fast charging capability usually comes with sacrificing cell durability. Here, we present a controllable cell structure to break this trade-off and enable lithium plating-free (LPF) fast charging.

dition, i.e., 3.5-C or 15-min fast charging at freezing temperatures. lithium-ion battery | fast charging |

temperature independent | lithium plating-free | rapid heating E lectric vehicles (EVs) have great promise in addressing cli-mate change and energy security issues (1). Automakers are now lining up to flood the market with a series of new ...

Low-temperature charging of lithium-ion cells part i: electrochemical modeling and experimental investigation of degradation behavior. J. Power Sources, 252 ... Optimal health-aware charging protocol for lithium-ion batteries: a fast model predictive control approach. IFAC-PapersOnLine, 49 (7) (2016) ...

Ten-minute fast charging enables downsizing of EV batteries for both affordability and sustainability, without causing range anxiety. However, fast charging of energy-dense batteries (more than 250 Wh kg -1 or higher than 4 mAh cm -2) remains a great challenge 3, 4.

Journal Article: Fast charging of lithium-ion batteries at all temperatures Title: Fast charging of lithium-ion batteries at all temperatures Journal Article · Fri Jun 01 00:00:00 EDT 2018 · Proceedings of the National Academy of Sciences of the United States of America

First are lithium titanium oxide batteries, which can survive more than 30,000 15C charge cycles; unfortunately, their less than 100 Wh kg -1 is not practical 5. Also in this unsuitable regime are supercapacitors and 0-25% SOC flash charging of lithium-ion batteries (LiBs).

None of today"s EVs can withstand fast charging in cold or even cool temperatures due to the risk of lithium plating. Efforts to enable fast charging are hampered by the trade-off nature of a lithium-ion battery: Improving low-temperature fast charging capability usually comes with sacrificing cell durability.

Lithium-ion batteries (LIBs) have been widely used in portable electronics and electric vehicles due to their high energy and power densities [1], [2].The demands of LIBs" fast charging capability are also increasing to reduce range anxiety with the popularity of EVs in recent years [3] is urgent and challenging to achieve the U.S. Advanced Battery Consortium ...

Two major barriers to mainstream adoption of plug-in electric vehicles (PEVs) are high cost and short drive range of lithium-ion batteries. 1 A single solution to both is to deploy 100-mile PEVs powered by ~20 kWh batteries combined with 5-15 min fast-charging infrastructure. This broadens PEV affordability due to the use of small batteries on-board, and alleviates drive ...

Abstract: Fast charging of lithium-ion battery (LIB) packs at low temperatures can have several effects on the performance and overall health of the battery. Repetitive fast charging at low temperatures accelerates internal resistance growth, leading to inefficient charging. Slow and inefficient chemical reactions at low temperatures result in slower charging rates and ...

To date, Li-ion batteries subject to quick charging in extreme cold grow lithium dendrites which consume

cyclable lithium thus severely shortening battery life and compromise safety. Here we experimentally demonstrate 3C fast charging at -30° C for more than 500 cycles using a new cell structure, the all-climate battery (ACB).

A new approach to charging energy-dense electric vehicle batteries, using temperature modulation with a dual-salt electrolyte, promises a range in excess of 500,000 miles using only rapid (under ...

However, charging of lithium-ion batteries in cold environments remains a challenge, facing the problems of prolonged charging time, less charged capacity, ... Effects of fast charging at low temperature on a high energy Li-ion battery. J Electrochem Soc, 167 (14) (2020), Article 140521.