



# High frequency welding technology of lithium battery cold plate

Lithium ion batteries are top-notch power sources for electric vehicle (EVs) because of high power and energy density [1, 2]. High elevated temperatures causes severe thermal issues in the lithium ion batteries [3, 4]. Lithium-ion batteries are not recommended if temperature is above 60 °C. To enhance battery performance, effective thermal management ...

The current paper evaluates the thermal performance of immersion cooling for an Electric Vehicle (EV) battery module comprised of NCA-chemistry based cylindrical 21700 format Lithium-ion cells.

1. Advantages of battery laser welding technology. The application of battery laser welding technology in lithium battery pack including ternary lithium battery and LFP battery has the following advantages:  
High-precision welding: Battery laser welding can achieve micron-level weld seam control, making the welding connection more uniform and ...

In this study, seven Z-type parallel channel cold plate and two novel cross-linked channel cold plate designs are proposed for the cooling of high-power lithium-ion batteries ...

**Abstract.** Thermal management is critical for safety, performance, and durability of lithium-ion batteries that are ubiquitous in consumer electronics, electric vehicles (EVs), aerospace, and grid-scale energy storage. Toward mass adoption of EVs globally, lithium-ion batteries are increasingly used under extreme conditions including low temperatures, high ...

Because resistance spot welding has the advantages of relatively mature technology, easy control, low cost, and high work efficiency, resistance spot welding has a wide range of applications in the connection of lithium batteries, especially in the manufacture of small-sized cylindrical battery cells like 18650 battery.

The primary side constant current adopts closed-loop control, which can adjust the high-frequency pulse width according to the actual output current. If it is worse, it adopts fixed pulse width modulation, which belongs to open-loop control. During spot welding, the spot welding needle and the weldment itself will have a great influence on the welding, so the ...

Several joining methods involving resistance welding, laser welding, ultrasonic welding and mechanical joining are currently applied in manufacturing lithium-ion batteries. Cu and Al alloys are used for tab and bus bar materials, and laser welding characteristics for these alloys were investigated with similar and dissimilar material combinations in this study.

Despite the advantages, the performance of lithium-ion batteries is clearly affected by temperature [5]. For example, at high temperatures, lithium-ion batteries can suffer from capacity attenuation and self-discharge [6]. Lithium-ion batteries can easily get overheated due to a short circuit and/or in an excessively high ambient



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temperature, which might even ...

Welding is one of the most important electrical connection methods for lithium-ion battery groups, and the quality of welding directly determines the thermal safety of battery modules. In this research, the inconsistencies and thermal safety of cylindrical lithium-ion battery modules ...

In this study, seven Z-type parallel channel cold plate and two novel cross-linked channel cold plate designs are proposed for the cooling of high-power lithium-ion batteries using two different cooling strategies. The average battery temperature, battery temperature uniformity and energy consumption of all designs are firstly analyzed holistically by three ...

This paper presents a comprehensive overview on joining battery cells by resistance spot, ultrasonic and laser beam welding. The specific features, advantages and ...

2.1. Geometry Models of the Battery Pack and Cold Plates. The battery studied in this work is LiFeO<sub>4</sub>/graphite pouch battery with a nominal voltage of 3.1 V and a nominal capacity of 20 Ah. Each battery cell is divided into three domains, the battery cell domain, the positive tab domain, and the negative tab domain. The geometry of the battery ...

Low temperature will reduce the power and stored energy of the battery, while the high temperature will easily cause spontaneous combustion, affecting the life and safety of the battery. The temperature difference inside the battery should be reduced as much as possible to minimize the damage due to thermal stress [4, 5]. The ideal operating temperature ...

Due to the high energy density of Lithium-ion battery cells of 18650-type (in this case 162 Wh/kg) the usage in energy storage devices increases. Furthermore these cells offer ready availability and low prices. To reach high and suitable energy capacity several of the cells have to be connected in parallel. The electrical connection is realised with overlap ...

This research findings shows the optimised wavy cold plate is the prominent solution for both warm-up and effective cooling strategies of the battery pack at high and low ...

Thermal Characteristics Investigation of Lithium-Ion Battery Under High-Frequency AC Excitation in Low-Temperature Environment March 2022 IEEE Transactions on Transportation Electrification 8(1 ...

Principle of lithium battery welding. In lithium battery production, the connection between the battery pole lug and the electrolyte conductor is one of the most important processes. This welding process usually uses high-frequency pulsed arc welding technology, through the application of instantaneous high temperature and high voltage ...



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IEEE TRANSACTIONS ON TRANSPORTATION 4ELECTRIFICATION generation model only shows that the heat generation is positively correlated with the root-mean-square (RMS) current value and

Numerical optimization of the cooling effect of a bionic fishbone channel liquid cooling plate for a large prismatic lithium-ion battery pack with high discharge rate. Journal of Energy Storage, 72 (2023), Article 108239. View PDF View article View in Scopus Google Scholar [40] F. Yao, X. Guan, M. Yang, C. Wen. Study on liquid cooling heat dissipation of Li-ion ...

Electric vehicle battery systems are made up of a variety of different materials, each battery system contains hundreds of batteries. There are many parts that need to be connected in the battery system, and welding is often the most effective and reliable connection method. Laser welding has the advantages of non-contact, high energy density, accurate heat ...

Among various welding methods, laser welding stands out for lithium-ion battery processing due to the following advantages: Firstly, laser welding offers high energy density, resulting in minimal welding deformation and a small heat-affected zone. This effectively enhances part accuracy, providing smooth, impurity-free, uniform, and dense weld seams ...

Proper thermal management of Lithium ion batteries is a crucial design consideration in electric vehicles (EV). Liquid cooling is the preferred choice due to its high heat transfer coefficient and compactness. Cold plates used for heat extraction need to maintain the batteries in a temperature range of 20-40C and a temperature uniformity of less than 5C between the ...

Qian et al. proposed an indirect liquid cooling method based on minichannel liquid cooling plate for a prismatic lithium-ion battery pack and explored the effects of the ...

This study examines the square 40 Ah ternary Li-ion battery manufactured by Amperex Technology Limited (ATL). The parameters of the battery and the physical parameters of each part are shown in Table 2, Table 3. Table 2. Battery parameter. Parameters Units Value; Capacity: Ah: 40: Nominal voltage: V: 3.7: Cut off voltage: V: 2.7-4.2: Maximum continuous ...

The purpose of this study is to design a new type of cold plate to improve the thermal performance of liquid-cooled thermal management system of lithium-ion batteries.

2021 new design lithium battery laser welding machine with XYZ three-axis is servo motor, large stroke range meets production needs, high precision and fast speed. 2021 new design lithium battery laser welding machine which has welding fixtures are customized according to customer drawings, with high precision . 2021 new design lithium battery ...

The qualification of production systems that enable reliable and stable production processes is a major



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challenge in manufacturing large-format lithium-ion batteries. During cell assembly, the electrode sheets of the anode and the cathode are stacked, and are electrically contacted by a welding process. It was shown that laser beam welding employing a beam ...

For lithium battery packs, the design of a battery thermal management system (BTMS) to improve thermal safety performance is crucial. Various forms of BTMS have been widely optimized through experiments and simulations. Air cooling research focuses primarily on the effects of the configuration of the battery pack [5, 6], the airflow rate [7], and the layout of ...

By the coupling optimization of welding sequences and welding parameters, the welding deformation of lithium battery pack decreased from 1.69 to 1.29 mm with the reducing rate of 23.7% and hundreds of welding seams contours met the requirements of manufacturing quality. These findings could pave the way to improve the manufacturing quality ...

In this study, seven Z-type parallel channel cold plate and two novel cross-linked channel cold plate designs are proposed for the cooling of high-power lithium-ion batteries using two different ...

Results show that the performance of inclined channel cold plate is much better than that of straight channel cold plate. The j/f factor of the straight channel cold plate is improved by 79.64% when the coolant is water, the mass flow rate is 0.6 g s<sup>-1</sup>, the channel number is 5 and the inclined angle is 15°. Furthermore, effects of inclined ...

The sizes of the batteries and cold plate are shown in ... Construction of unique heterogeneous cobalt-manganese oxide porous microspheres for the assembly of long-cycle and high-rate lithium ion battery anodes. J. Mater. Chem. A., 7 (2019), pp. 6149-6160, 10.1039/C8TA09028A. View in Scopus Google Scholar [4] P. Wang, M. Shen, H. Zhou, C. ...

Thermal analysis and thermal management of lithium-ion batteries for utilization in electric vehicles is vital. In order to investigate the thermal behavior of a lithium-ion battery, a liquid cooling design is ...

The results indicated that vibration had the effect of enhancing the heat transfer capacity of the cold plate, which was related to the frequency, amplitude and mass flow rate. Under the vibration of 10 Hz and 0.8 mm, when mass flow rate was set to 5 g/s, the maximum temperature of the cold plate was reduced by 4.35 K while the temperature difference was ...

Lithium-ion batteries are widely used in electric vehicles because of their high capacity and voltage. However, some drawbacks to the battery stability exist. The aim of our research was to determine the optimum width and number of channels of a cold plate. To estimate the temperature distribution and heat transfer rate, the MSMD (multi-scale multi ...



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Wang et al. proposed a novel bionic spiderweb-like channel cold plate for improving the cooling effect of the battery. The study explores how a spiderweb-like channel design affects lithium-ion battery cooling at a high 12C discharge rate. Orthogonal experiments show that channel width most impacts cooling, while the angle has the least effect ...

Lithium-ion batteries (LIBs) are commonly adopted by electric vehicles (EVs), large-scale energy storage systems, and portable electronic devices, due to their superior properties, including high energy density, low self-discharge rate, and long cycle life (Maknikar and Pawar, 2023, Tran et al., 2021, Vashisht et al., 2023). However, with the advancement of ...

The battery thermal management system is a key solution for the above issue. Air cooling [15, 16], liquid cooling [17, 18], phase change material cooling [19, 20], and heat pipe cooling [21, 22] are commonly used in battery thermal management systems. The liquid cooling is the mainstream cooling method for electric vehicle lithium-ion battery pack due to its ...

This study experimentally investigated thermal performance of water-cooled cold plates used in thermal management of batteries by using conventional serpentine tube and a novel mini channel designs including a lithium-ion phosphate battery under certain discharge rates from 1C to 5C. Experiments are conducted for different water flow rates from 0.1 to 1.1 ...

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