The lithium-ion battery state of the art and future perspectives

Lithium-ion batteries are dominant electrochemical energy storage devices, whose safe and reliable operations necessitate intelligent state monitoring [1], [2], [3] particular, state of charge (SOC), which is defined as the ratio of the available capacity to the maximum capacity, is a fundamental state to ensure proper battery management [4]. ...

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Currently, lithium-ion batteries (LIBs) represent one of the most prominent energy storage systems when compared to other energy storage systems (Fig. 1), with a compound annual growth rate (CAGR) of 17.0% and an expected global value of US $ 93.1 billion by 2025 [4].When compared to other battery technologies, LIBs are lighter, cheaper, show higher ...

Accurate state of charge (SOC) constitutes the basis for reliable operations of lithium-ion batteries. The deep learning technique, a game changer in many fields, has recently emerged as a promising solution to accurate SOC estimation, particularly in the era of battery big data consisting of field and testing data. It enables end-to-end SOC estimation using raw ...

Sulfur remains in the spotlight as a future cathode candidate for the post-lithium-ion age. This is primarily due to its low cost and high discharge capacity, two critical requirements for any future cathode material that seeks to dominate the market of portable electronic devices, electric transportation, and electric-grid energy storage. However, before Li-S batteries ...

Lithium-ion batteries are the state-of-the-art electrochemical energy storage technology for mobile electronic devices and electric vehicles. Accordingly, they have attracted a continuously increasing interest in academia and industry, which has led to a steady improvement in energy and power density, while the costs have decreased at even faster pace.

The first rechargeable lithium battery was designed by Whittingham (Exxon) and consisted of a lithium-metal anode, a titanium disulphide (TiS 2) cathode (used to store Li-ions), and an electrolyte composed of a lithium salt dissolved in an organic solvent. 55 Studies of the Li-ion storage mechanism (intercalation) revealed the process was ...

(DOI: 10.1016/J.RSER.2018.03.002) Lithium-ion batteries play an important role in the life quality of modern society as the dominant technology for use in portable electronic devices such as mobile phones, tablets and laptops. Beyond this application lithium-ion batteries are the preferred option for the emerging electric vehicle sector, while still underexploited in power ...

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It is already difficult to forecast future demand for lithium, and other battery raw materials, as forecasts for passenger EV sales and their associated lithium-ion battery demand vary wildly.

Being successfully introduced into the market only 30 years ago, lithium-ion batteries have become state-of-the-art power sources for portable electronic devices and the most promising candidate for energy storage in stationary or electric vehicle applications.

The report "Electric Vehicle Battery Technologies: From Present State to Future Systems" outlined a taxonomy encompassing six distinct battery technologies utilized in electric vehicles: lead-acid "Pb-acid", nickel-cadmium "Ni-Cd", nickel-metal hydride "NiMH", lithium-ion "Li-ion", lithium-ion polymer "LiPo", and ...

The advantages and disadvantages of Ca 2+ ion batteries including prospective achievable energy density, cost reduction due to high natural abundance, low ion mobility, the effect of ion size, and the need for elevated temperature operation are reviewed. The use of density functional theory modeling to predict the properties of Ca-ion battery ...

A critical assessment on the main advantages and disadvantages should be performed for each type of battery [2].The main advantages and disadvantages of the use of lithium ion batteries when compared to other types of batteries such as Ni-Cd, Lead-Acid battery and Nickel-Metal Hydride Cells are illustrated in Table 1 comparing lithium ion batteries ...

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This paper presents an analysis of the articles, which includes the distribution of articles based on state of the art for lithium-ion battery materials, the publication trend, the top 10 papers with technical comparison, co-occurrence keyword analysis, the country where the articles were published, the subject areas, the impact factors, and ...

As it has been the case for state of art technologies such as those in lithium-ion batteries, Mg battery electrolytes will also need to be optimized for such high voltage operation of the cathode. The cathode/electrolyte interface will have to ...

Lithium solid-state batteries (SSBs) are considered as a promising solution to the safety issues and energy density limitations of state-of-the-art lithium-ion batteries. Recently, the possibility of developing practical SSBs has emerged thanks to striking advances at the level of materials; such as the discovery of new highly-conductive solid ...

According to Yang et al. (2018), there are about 230,000 Mt of Li dissolved in the seawater and it is present in

the Earth"s crust at between 20 and 70 ppm by weight, mainly in igneous granite rocks.New clays like hectorite resources are rare. This creates a significant problem for scientists to develop novel approaches for efficient extraction processes from ...

Since the commercialization of Lithium ion batteries (LiBs), strong strides have been taken to enhance the performance (power and energy density, cycle life) while reducing manufacturing cost per kWh. With the push for adoption of electric vehicles worldwide, LiBs are the preferred choice for rechargeable energy storage systems (RESS). The performance and cost of electric ...

An overview of the evolution of the lithium-ion battery, state-of-the-art developments, and opportunities and challenges in energy storage can be garnered through these Nobel laureates" perspectives, reviews, and viewpoints. 1,2,10,11,17,26 The development of new cathode 3,4,9, 11-13,15,19,21,24,25,27 and anode 29, 31 materials has been an ...

Silicon-Based Lithium Ion Battery Systems: State-of-the-Art from Half and Full Cell Viewpoint. Junpo Guo, Junpo Guo. Guangdong-Hong Kong-Macau Joint Laboratory for Photonic-Thermal-Electrical Energy Materials and Devices, Institute of Applied Physics and Materials Engineering, University of Macau, Avenida da Universidade, Taipa, Macao SAR ...

This mechanism opens new perspectives in the field of lithium ion conductors, and beyond LTPS, opens an avenue toward the search for new materials with similar diffusion mechanisms. ... The lithium-ion battery: State of the art and future perspectives. Renew Sust Energ Rev. 2018; 89: 292-308. Li P, Bashirullah R. A wireless power interface for ...

Lithium-ion batteries are becoming increasingly important for electrifying the modern transportation system and, thus, hold the promise to enable sustainable mobility in the future. However, their large-scale application is hindered by severe safety concerns when the cells are exposed to mechanical, ...

The complexity of lithium ion batteries with varying active and inactive material chemistries interferes with the desire to establish one robust recycling procedure for all kinds of lithium ion batteries. Therefore, the current state of the art needs to be analyzed, improved, and adapted for the coming cell chemistries and components.

Journal Article: Automotive Li-Ion Batteries: Current Status and Future Perspectives ... High-Power Nanostructured LiMn 2-x Ni x O 4 High-Voltage Lithium-Ion Battery Electrode Materials: ... The lithium-ion battery: State of the art and future perspectives. Zubi, Ghassan; Dufo-López, Rodolfo; Carvalho, Monica ...

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