Modification of Lithium-ion Battery Electrode Materials

Can electrode materials be used for next-generation batteries?
Ultimately,the development of electrode materials is a system engineering,depending on not only material properties but also the operating conditions and the compatibility with other battery components,including electrolytes,binders,and conductive additives. The breakthroughs of electrode materials are on the wayfor next-generation batteries.

What are lithium-ion battery anode materials?
In terms of lithium-ion battery anode materials,graphite(mainly natural and artificial graphite) occupies 90 % of the anode material markets owing to the mature technology,lower cost and better performance.

Do electrode materials affect the life of Li batteries?
Summary and Perspectives As the energy densities,operating voltages,safety,and lifetime of Li batteries are mainly determined by electrode materials,much attention has been paid on the research of electrode materials.

Which materials should be used for the next generation lithium-ion batteries?
The abundant silicon-based anode materialsare considered as one of the preferred materials for the next generation high energy density lithium-ion batteries (LIBs) due to the high theoretical capacity.

How does a non-uniform Lithium Expansion affect a lithium anode?
Under different DODs,the lithium concentration gradient of Si 8.5 Sn 0.5 Sb anode was larger than that of the Si anode,and the volume strain was quite uniform. The non-uniform lithium expansion of the Si anode resulted in higher Von Mises stress levels and a greater propensity for mechanical failure.

How can electrode materials be used in practical applications?
The practical application of emerging electrode materials requires more advanced research techniques, especially the combination of experiment and theory, for material design and engineering implementation. Despite the property of high energy density, the future development of electrode materials also needs attention on the following aspects:

Recent improvements for the positive electrodes have been obtained by well-crystallized surface layer of both lamellar compounds and olivine compounds. The increase of energy density with...

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This article reviews recent research about surface-interface modification in electrodes and organic liquid electrolytes in LIBs. Specifically, the basic growth mechanism of...

Herein, the key historical developments of practical electrode materials in Li-ion batteries are summarized as the cornerstone for the innovation of next-generation batteries. In addition, the emerging electrode materials for next-generation batteries are discussed as the revolving challenges and potential strategies.

Modification of electrodes by lattice doping and coatings may play a critical role in improving their electrochemical properties, cycle life, and thermal behavior. This chapter ...

Surface modification by atomic layer deposition (ALD) is an essential method to optimize the performance of the electrode materials. The research in this thesis aims at achieving high ...

In short, the electron beam-assisted synthesis and surface modification of PE separators for lithium-ion batteries is embodied in grafting and coating other materials with PE. ...

Surface modification by atomic layer deposition (ALD) is an essential method to optimize the performance of the electrode materials. The research in this thesis aims at achieving high-performance LIBs via surface modification and understanding the ...

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2.1 Mechanism for charge (electron/ion) movement and storage. The mechanism can be classified either by electron moment or by the structure of functional groups. From the mechanism point of view, whether electron is gained or lossed during the redox process, all the reported materials can be classified into three types, as shown in Fig. 2a-c: n-type: ...

Electrolyte modifications are also important ... The last couple of decades have been an exciting time for research in the field of Li-ion battery electrode materials. As new materials and strategies are found, Li-ion batteries will no doubt have an ever greater impact on our lives in the years to come. Acknowledgements. The authors gratefully acknowledge ...

The research on the electrodes of Li-ion batteries aims to increase the energy density and the power density, improve the calendar and the cycling life, without sacrificing the safety issues. A constant progress through the years has been obtained owing to the surface treatment of the particles, in particular the coating of the particles with a layer that protects the ...

In the LIBs system, lithium-ions transfer freely through the electrolyte solution, accomplishing the charge-discharge process along with the highly reversible de-insertion ...

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Herein, based on a columnar lithium-ion diffusion electrode model, a double high-elastic-modulus modification (DHEMM) method is proposed to inhibit deformation and ...

In short, the electron beam-assisted synthesis and surface modification of PE separators for lithium-ion batteries is embodied in grafting and coating other materials with PE. Such grafted and coated PE has excellent wettability and mechanical property and can effectively improve the battery performance, including high energy, longer ...

Silicon (Si) is recognized as a promising candidate for next-generation lithium-ion batteries (LIBs) owing to its high theoretical specific capacity (~4200 mAh g-1), low working potential (<0.4 V vs. Li/Li+), and abundant reserves. However, several challenges, such as severe volumetric changes (>300%) during lithiation/delithiation, unstable solid-electrolyte interphase ...

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