

Sustainability of lithium ion batteries

Are lithium ion batteries sustainable?

Lithium ion batteries, which are typically used in EVs, are difficult to recycle and require huge amounts of energy and water to extract. Companies are frantically looking for more sustainable alternatives that can help power the world's transition to green energy.

Can second life & recycling influence the energy and environmental sustainability of lithium-ion batteries?

Second life and recycling of retired automotive lithium-ion batteries (LIBs) have drawn growing attention, as large volumes of LIBs will retire in the coming decade. Here, we illustrate how battery chemistry, use, and recycling can influence the energy and environmental sustainability of LIBs.

How can recycling improve the sustainability of lithium ion batteries?

Developing recycling technologies that are both economically and environmentally favorable can largely enhance the sustainability of LIBs. Recycling can in turn reduce the energy consumption and emissions during the virgin battery production.

Does battery chemistry affect environmental sustainability?

Here, we illustrate how battery chemistry, use, and recycling can influence the energy and environmental sustainability of LIBs. We find that LIBs with higher specific energy show better life cycle environmental performances, but their environmental benefits from second life application are less pronounced.

Is lithium-ion battery manufacturing energy-intensive?

Nature Energy 8,1180-1181 (2023) Cite this article Lithium-ion battery manufacturing is energy-intensive, raising concerns about energy consumption and greenhouse gas emissions amid surging global demand.

Why do lithium-ion batteries need to be recycled?

“Recycling a lithium-ion battery consumes more energy and resources than producing a new battery, explaining why only a small amount of lithium-ion batteries are recycled,” says Aqsa Nazir, a postdoctoral research scholar at Florida International University's battery research laboratory.

This study on lithium-based LCA batteries is a thorough evaluation of how lithium-ion batteries affect the economy, society, and environment--the three cornerstones of sustainability. The goal of the study is to provide an in-depth comprehension of the whole life cycle of these batteries, starting with the extraction of the raw materials and ...

The leapfrog development of LIB industry has resulted in significant demand on mineral resources and thus challenges to its sustainability. In 2018, worldwide lithium production increased by an estimated 19% to 85,000 tons in response to increased lithium demand for battery productions [20]. A similar situation is seen

for cobalt.

“Sodium is a much more sustainable source for batteries [than lithium],” says James Quinn, chief executive of Faradion, the UK-based battery technology company that manufactures the sodium-ion ...

The sustainability of cobalt is an important emerging issue because this critical base metal is an essential component of lithium-ion batteries for electric vehicles. More than half the world's cobalt mine production comes from the Katanga Copperbelt in DR Congo, with a substantial proportion (estimated at 15-20%) being extracted by artisanal ...

Global lithium-ion battery deployments stand poised to grow substantially in the coming years, but it will be necessary to include sustainability considerations in the design of electrode materials.

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.

This article outlines principles of sustainability and circularity of secondary batteries considering the life cycle of lithium-ion batteries as well as material recovery, component ...

Lithium-ion insertion and extraction compounds based on layered oxide frameworks are widely used as cathode materials in high-energy-density Li-ion batteries 1,2,3,4,5,6,7,8,9. Owing to the ionic ...

lithium-ion batteries, to advances in solid state batteries, and novel material, electrode, and cell manufacturing methods, remains integral to maintaining U.S. leadership. ... sustainability, and support a U.S.-based circular materials supply chain Support research, development, and demonstration ...

Rechargeable lithium-ion batteries based on manganese oxide electrode materials are more environmentally friendly than conventional ones but generally suffer from rapid performance fading. A ...

The global electric vehicle (EV) stock grew to 10 million in 2020, and 160 GWh LIBs were produced to power these electric cars 3. With deeper EV penetration, global lithium demand has reached a new ...

One of the more popular questions relating to lithium-ion batteries searched on Google is this: are lithium-ion batteries sustainable? It is a question people want an answer to. Unfortunately, the answer is not as straightforward and simple.

Dear Colleagues, Electric vehicles continue to gain market share, in part driven by governmental initiatives to clean up urban air, as such, we invite you to contribute to a Special Issue of Batteries, organized around the theme of the sustainability of lithium-ion batteries that are "under the hood" of these vehicles is important that

researchers developing battery ...

1 INTRODUCTION. Lithium-ion batteries (LIBs) are ubiquitous in our everyday life, powering our power tools, mobile phones, laptops, and other electronic devices--and increasingly also (hybrid) electric vehicles. 1-3 The anticipated, ...

Finding scalable lithium-ion battery recycling processes is important as gigawatt hours of batteries are deployed in electric vehicles. Governing bodies have taken notice and have begun to enact ...

But a 2022 analysis by the McKinsey Battery Insights team projects that the entire lithium-ion (Li-ion) battery chain, from mining through recycling, could grow by over 30 percent annually from 2022 to 2030, when it would reach a value of more than \$400 billion and a market size of 4.7 TWh. 1 These estimates are based on recent data for Li-ion ...

Nature Sustainability - The authors present a FeCl_3 cathode design that enables all-solid-state lithium-ion batteries with a favourable combination of low cost, improved safety and good ...

Electric vehicles powered by lithium-ion batteries are viewed as a vital green technology required to meet CO₂ emission targets as part of a global effort to tackle climate change. Positive electrode (cathode) materials within such batteries are rich in critical metals--particularly lithium, cobalt, and nickel.

Battery recycling is essential to the sustainability of electric vehicles. Here the authors show processes that could regenerate spent cathode materials for a second life in lithium-ion and post ...

Owing to the rapid growth of the electric vehicle (EV) market since 2010 and the increasing need for massive electrochemical energy storage, the demand for lithium-ion batteries (LIBs) is expected to double by 2025 and quadruple by 2030 ().As a consequence, global demands of critical materials used in LIBs, such as lithium and cobalt, are expected to grow at similar ...

Operational performance and sustainability assessment of current rechargeable battery technologies. a-h) Comparison of key energy-storage properties and operational characteristics of the currently dominating rechargeable batteries: lead-acid (Pb-acid), nickel-metal hydride (Ni-MH), and lithium-ion batteries.

Lithium-ion batteries (LIBs) can play a crucial role in the decarbonization process that is being tackled worldwide; millions of electric vehicles are already provided with or are directly powered by LIBs, and a large number of them will flood the markets within the next 8-10 years. Proper disposal strategies are required, and sustainable and environmental impacts ...

The Sustainability of Lithium-ion Technology: A Ways to Go Mining & Production. Lithium may be the third most common element on earth, after hydrogen and helium, but is not easily mined. ... A lithium-ion battery is ...

As I wind down my Editorial activities this fall, I will also be wrapping up a significant phase of my own research. For the last seven years, my research group has been studying the sustainability challenges surrounding lithium-ion batteries and their end-of-life management after use in electric vehicles, thanks to funding provided by the National Science Foundation ...

1 Introduction. Li-ion batteries (LIBs) have achieved remarkable success in electric vehicles (EVs), consumer electronics, grid energy storage, and other applications thanks to a wide range of electrode materials that meet the performance requirements of ...

The pursuit of industrializing lithium-ion batteries (LIBs) with exceptional energy density and top-tier safety features presents a substantial growth opportunity. The demand for energy storage is steadily rising, driven primarily by the growth in electric vehicles and the need for stationary energy storage systems. However, the manufacturing process of LIBs, which is ...

Lithium-ion batteries offer a contemporary solution to curb green-house gas emissions and combat the climate crisis driven by gaso-line usage. Consequently, rigorous research is currently underway to improve the performance and sustainability of current lithium-ion batteries or to develop newer battery chemistry. However, as

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