

# Alternatives to cobalt in lithium battery cathode materials

How to reduce cobalt content in lithium-ion batteries?

One approach to reducing cobalt content in lithium-ion batteries is to use alternative cathode materials. For example, researchers have explored the use of lithium-manganese-oxide (LMO) and lithium-nickel-manganese-cobalt-oxide (NMC) cathodes, which can provide similar performance to traditional cobalt-based cathodes while using less cobalt.

Can a lithium ion battery replace cobalt in a cathode?

Other approaches consider the total replacement of cobalt in the cathode. One potential replacement for cobalt is nickel. Nickel-based lithium-ion batteries have been shown to have a higher energy density than cobalt-based batteries, which means they can store more energy in a smaller space.

What are alternatives to cobalt based batteries?

This could lead to the development of smaller and more efficient batteries. Another alternative to cobalt is manganese, which has been used in lithium-ion batteries for many years. Manganese-based batteries are less expensive to produce than cobalt-based batteries and are also less toxic to the environment.

Can a lithium-manganese-oxide cathode replace cobalt?

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Could a carbon-based cathode replace cobalt?

Now, researchers in ACS Central Science report evaluating an earth-abundant, carbon-based cathode material that could replace cobalt and other scarce and toxic metals without sacrificing lithium-ion battery performance. Today, lithium-ion batteries power everything from cell phones to laptops to electric vehicles.

Could a carbon-based cathode replace a lithium-ion battery?

However, their cathodes typically contain cobalt -- a metal whose extraction has high environmental and societal costs. Now, researchers in ACS Central Science report evaluating an earth-abundant, carbon-based cathode material that could replace cobalt and other scarce and toxic metals without sacrificing lithium-ion battery performance.

Cobalt-based layered materials have been dominant as cathodes for the rechargeable lithium-ion battery since it was introduced in 1991. Recently, the focus has been on finding novel cathode materials that have significantly higher capacity or voltage than lithium cobalt oxide (practical specific capacity ~ 140 mA h/g and average voltage ~ 3 ...

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The new lithium-ion battery includes a cathode based on organic materials, instead of cobalt or nickel (another metal often used in lithium-ion batteries). In a new study, the researchers showed that this material, ...

With high-Ni layered oxides as the cathode material to reduce the use of cobalt, a large number of battery manufacturers have made tremendous efforts to ensure that EVs can reach price parity with internal combustion engine (ICE) vehicles (US\$100 kWh<sup>-1</sup>).

Finding suitable, high-performing cobalt alternatives, is however easier said than done. Enter Malvern Panalytical. One inspiring innovation achieved in 2020 at Oak Ridge National Laboratory was the development of long-lasting, cobalt-free cathode materials made from nickel, iron, and aluminum, using Malvern Panalytical's X<sup>2</sup>Pert diffractometer.

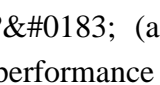
Nickel-manganese-cobalt (NMC) based cathode active materials (CAMs) with high Ni content are preferred in lithium-ion batteries (LIBs), especially for those powering ...

Challenges of cobalt in lithium-ion batteries. In many ways, cobalt is a victim of its own success. Driven by the increasing use of Li-ion batteries in EVs and consumer electronics, cobalt demand and prices have risen sharply in recent years. Cobalt is also considered the highest material supply chain risk in battery production, with factories located far from cobalt ...

The history of lithium-ion battery technology dates back to the 1970s when researchers began exploring the potential of lithium as a battery material due to its low electrochemical potential. In the 1980s, Sony ...

MIT researchers have now designed a battery material that could offer a more sustainable way to power electric cars. The new lithium-ion battery includes a cathode based on organic...

In Li-ion batteries, particularly those using lithium cobalt oxide or nickel-manganese-cobalt chemistries, cobalt enhances the stability of the cathode material. This stability is crucial for preventing the cathode from degrading over time, which can lead to a loss of battery capacity and efficiency. Cobalt's ability to endure high temperatures also helps maintain

2  (a-f) Hierarchical Li<sub>1.2</sub>Ni<sub>0.2</sub>Mn<sub>0.6</sub>O<sub>2</sub> nanoplates with exposed 010 planes as high-performance cathode-material for Li-ion batteries, (g) discharge curves of half cells based ...

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Panalytical. One inspiring innovation achieved in 2020 at Oak Ridge ...

Scientists are looking to identify alternatives to lithium-ion batteries that rely on cobalt, an African-mined metal drawing scrutiny over human rights issues and environmental problems.. Cobalt ...

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Cobalt-based layered materials have been dominant as cathodes for the rechargeable lithium-ion battery since it was introduced in 1991. Recently, the focus has been on finding novel cathode materials that have significantly ...

Beyond reducing cobalt content, much research is invested into cobalt-free alternatives. Commercialized options available ... current research is focused on understanding the structure-property relationships in high-voltage substituted spinel cathode materials for lithium-ion batteries using X-ray and neutron diffraction techniques. Kathryn E. Toghil joined ...

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