High Entropy Doping in Sodium-Ion Batteries

Tech ID: 32476 / UC Case 2020-670-0

BRIEF DESCRIPTION

A breakthrough method of doping sodium-ion battery cathodes to enhance performance and sustainability. The inventors at UCI have created a method of doping layered cathode materials in sodium-ion batteries. In this method more than five impurity elements are introduced into a host material, in this case a sodium-based layered cathode material, Na0.667Mn0.666Ni0.167Co0.167O2. This technique is being utilized in order to create sodium-ion batteries that are more competitive with the historically used lithium-ion battery.

SUGGESTED USES

· Manufacture of high-energy-density sodium-ion batteries for portable devices.

· Development of sustainable and long-life batteries for electric vehicles.

· Energy storage solutions that reduce reliance on critical materials like lithium and cobalt.

FEATURES/BENEFITS

· Higher discharge capacity at low rates compared to conventional sodium-ion batteries.

· Superior performance with high discharge capacity at 1-hour charge/discharge cycles, surpassing lithium-ion batteries.

· Slower capacity fading, ensuring longer battery life.

· Reduced impedance growth over time, enhancing performance stability.

· Decreased reliance on cobalt, a toxic and less environmentally friendly element.

TECHNOLOGY DESCRIPTION

Li-ion battery technology has been the historical go-to for powering portable devices and vehicles. However, lithium is sourced only from a handful of countries and is difficult to recycle. Sodium, on the other hand, is an element which is widely abundant and inexpensive. There are several issues which have, in the past, kept Na-ion batteries from becoming the standard. Sodium cathode material is low in specific capacity, does not have a good rate performance, and has an unsatisfactory life cycle.

Researchers at UCI have pioneered a "high entropy" or "cocktail" doping technique for sodium-ion batteries, introducing more than five impurity elements into sodium-based layered cathode materials. This innovative approach significantly improves the energy density, cycle life, and overall performance of sodium-ion batteries, making them a viable and competitive alternative to lithium-ion batteries.

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

» **Energy**
» Storage/Battery
» **Materials & Chemicals**
» Other
» **Engineering**
» Other

RELATED CASES

2020-670-0

STATE OF DEVELOPMENT

The researchers are working on a prototype.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	12,469,847	11/11/2025	2020-670

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- A New Doping Strategy for Layered Oxide Electrode Materials Used in Lithium-Ion Batteries

UCI Beall Applied Innovation

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