Can sodium ion batteries be replaced

Can sodium ion batteries be replaced

Sodium-ion batteries are batteries that use sodium ions (tiny particles with a positive charge) instead of lithium ions to store and release energy. Sodium-ion batteries started showing commercial viability in the 1990s as a possible alternative to lithium-ion batteries, the kind commonly used in phones and electric cars.

Sodium could be competing with low-cost lithium-ion batteries --these lithium iron phosphate batteries figure into a growing fraction of EV sales. Take a tour of some other non-lithium-based...

Can sodium-ion batteries replace lithium-ion ones? Sweden"s Northvolt has developed an energy storage technology that has no lithium, cobalt, graphite or nickel. This could help to minimise green energy transition dependence on China

That idea has resurfaced, as several battery companies have begun manufacturing sodium-ion batteries as greener alternatives to lithium-ion batteries. Sodium is just below lithium in the periodic table of the elements, meaning their chemical behaviors are very similar.

Observations confirm a theoretical model explaining how--in Earth"s magnetosphere--large-scale magnetic waves heat up the magnetosphere"s plasma by transferring their energy to smaller-scale acoustic waves.

With the skyrocketing demand of lithium-ion batteries driven by global net zero policies and the shift towards electric vehicles and renewable energies, the pressure on battery raw materials has significantly increased. Supply shortages in the coming decades for battery materials such as lithium, cobalt, and nickel have been predicted. Technological diversification is key to counteract these risks. Are sodium-ion batteries the solution?

Sodium, for example, is ubiquitously available and will resolve the dependence on a small number of lithium markets currently experienced by battery OEMs. However, sodium-ion batteries also contain critical and toxic materials such as vanadium in $Na_3V_2(PO_4)_2F_3$ cathodes. Analyses of the future sodium-ion battery market can help predict potential shortfalls and supply chain risks and help prepare for these.

Sophisticated battery degradation models already applied to lithium-ion batteries, such as those developed by ACCURE, and early-on data collection of the cycling behavior of batteries in use will accelerate the understanding and prediction of the lifetime of sodium-ion batteries. The resulting knowledge can then be used by battery developers to develop rational design strategies for sodium-ion materials with high cycle lifetimes.

It also needs to be differentiated between the various cathode materials used in sodium-ion batteries. Polyanionic materials might behave differently to the layered oxides - similarly to the observations made for lithium-ion batteries, where, for instance, $LiFePO_4$ (LFP) presents higher thermal stability than $LiNiMnCoO_2$

(NMC) materials. More in-depth studies are needed to understand the effect of the various failure mechanisms (thermal, electrical, mechanical) on chemical reactions happening in sodium-ion batteries and the related safety implications.

Lithium-ion batteries have come under heavy scrutiny due to their high environmental impacts. These include energy and water-intense mining activities - which further cause damage to the local biodiversity - high energy consumption, and the use of harsh and toxic chemicals throughout the manufacturing and recycling processes.

The question is, if these impacts can be avoided by sodium-ion batteries. For example, the indirect emissions in the value chain caused by the electricity production needed in the various steps are eliminated by decarbonizing the electricity grid, not by switching the battery system.

Also, most of the manufacturing steps of sodium-based materials are similar to that of lithium-ion batteries and, therefore, might not impact on the overall energy requirements. As mentioned above, recycling is as necessary yet complex for sodium-ion batteries as for lithium-ion batteries, which means that no benefits are made by switching.