

Sodium-ion battery

July 16, 2022

In news– According to a study by University of Houston, **Sodium-based battery technology might soon be a viable alternative to lithium-based ones.**

About Sodium-based battery-

- **The sodium-ion battery is a type of rechargeable battery analogous to the lithium-ion battery** but using sodium ions (Na⁺) as the charge carriers.
- **Its working principle and cell construction are almost identical** with those of commercially widespread lithium-ion battery types, but sodium compounds are used instead of lithium compounds.
- **A homogeneous glassy electrolyte has been developed** by a professor at the Electrical & Computer Engineering department of Cullen College of Engineering and his colleagues at the University of Houston.
- **The electrolyte makes it significantly more viable to produce sodium ion-based batteries** commercially and on a larger scale.
- **It enables reversible sodium plating and stripping at a greater current density.**
 - While lithium does have many advantages, **lithium carbonate prices are at an all-time high.**
 - **It had been difficult to achieve stable plating and stripping of sodium metal** using a sulphide electrolyte until now. The process developed by the **professor's team has solved this issue.**
 - According to the team, the quest for new solid electrolytes for all-solid sodium batteries must concurrently be low cost, easily fabricated, and have incredible mechanical and chemical stability.

- To date, no single sodium solid electrolyte has been able to achieve all four of these requirements at the same time and the **new form of oxysulfide glass electrolyte fulfils all the conditions.**
- The study suggested that **ambient temperature solid-state sodium-sulfur battery technology can be used for grid-level energy storage systems with the help of the new electrolyte.**
- The positively charged metallic ion in sodium or lithium takes the charge from the anode to the cathode of a battery when the circuit is completed. This **process is called stripping of the anode.**
- When a battery is charged, the formation of sodium/lithium occurs around the anode of the battery in its metallic form. This is called **plating or deposition.** The **positive ions must be free to move about** because this movement is what produces electric energy.
- **Sodium batteries earlier required three times the volume of lithium** needed to produce the same amount of energy. This disadvantage discouraged scientists from working towards making sodium-based batteries.
- The University of Houston isn't the only place researching sodium ion-based batteries. **Several commercial companies are using Prussian blue analogue as the positive electrode** in their batteries to overcome issues of sodium ions.
- **Prussian blue is a pigment typically used in dyes and paints.** Its chemical structure is suitable for **soaking up and releasing sodium ions**, resulting in batteries that can charge and discharge in minutes and deliver quick bursts of energy.
- While this is very advantageous for specific applications, **it cannot support long-duration,**

grid-scale energy storage.

- **Homogeneous glass electrolytes have the potential to overcome this issue if used in sodium-ion batteries.**

Advantages of Sodium-ion batteries-

- **The new structural and compositional design strategies presented in this work provide a new paradigm** in the development of safe, low-cost, energy-dense, and long-lifetime solid-state sodium batteries.
- **Sodium-ion batteries will be cheaper to produce than their lithium counterparts** because of the abundance of the raw materials required to make them.
- **Lithium extraction and mining also involve a lot of chemicals leaching and spilling into** the ecosystem around its mines.
- **The process of recycling lithium-ion batteries is even more expensive than the extraction of lithium** and as a result, the market usually ends up disposing of it instead, much to the detriment of our planet and its resources.

Further reading:
<https://journalsofindia.com/solid-state-batteries/>