

# Sodium-ion (Na-ion) batteries

written by iasexam.com | 26/05/2023



**Context-** By developing new cathode materials that offer high performance, cost-effectiveness, and environmental stability, Indian scientists have recently made a significant advancement in the development of Sodium-ion (Na-ion) batteries.

## **Key Highlights**

- Sodium-transition-metal-oxide (Na-TM-Oxide)-based cathode materials are currently plagued by air/water instability and structural cum-electrochemical instability. As a result of this development, energy storage systems that are both stable and effective can now be developed.

## **What new cathode materials have been developed?**

- Cathode material is the terminal where sodium particles are put away during the battery's release cycle.
- Responsible for the electrochemical responses permit the progression of electrical flow.
- The recently evolved cathode materials are known for being air/water-steady and superior execution.
- When exposed to air or water, they exhibit high electrochemical cyclic stability and stability.

## **Significance:**

- The recently evolved cathode materials for Sodium-particle batteries offer elite execution, cost-adequacy, and natural kind disposition.
- These materials are making ready for the improvement of effective and economical energy stockpiling frameworks for different applications like buyer gadgets, matrix

energy capacity, sustainable power stockpiling, and electric vehicles.

### **What is Sodium-ion (Na-ion) Battery?**

- A sodium-ion battery is a type of rechargeable battery that is similar to the common lithium-ion battery but uses sodium ions ( $\text{Na}^+$ ) instead of lithium ions ( $\text{Li}^+$ ) as charge carriers.
- The functioning standards behind and cell development of a sodium-particle battery is basically indistinguishable from those of lithium-particle batteries, however sodium compounds are utilized rather than lithium compounds.
- Sodium-particle batteries are as of now arising as an expected option in contrast to current lithium-particle battery innovation because of their lower cost, higher accessibility, and decreased influence on the climate.
- **Importance:**
  - Beyond conventional Lithium-ion (Li-ion) batteries, the development of cost-effective, resource-friendly, safe, and sustainable alkali metal-ion battery systems is necessary due to the growing significance of battery-driven electric vehicles in addressing climate and environmental issues.
  - The Na-ion battery system is especially important in India because it provides a readily available and abundant resource for the production of Na-ion batteries.
- **Challenges:**
  - The structural and electrochemical stability of the electrodes, sodium-ion transport kinetics, and various dynamic resistances all influence the performance of Na-ion batteries.
  - However, in order for Na-ion battery systems to be widely used, significant advancements in the electrochemical behavior and stability of sodium-based cathode materials are required.