

Fundamentals and Challenges of Sodium-Ion Batteries: Towards a Sustainable Energy Future

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Sodium-ion batteries (NIBs) have emerged as a promising alternative to lithium-ion batteries, especially in the context of sustainability and resource availability. This lecture aims to provide an in-depth understanding of the fundamental principles behind sodium-ion battery technology, including electrochemical mechanisms, material selection, and the unique advantages that sodium ions offer compared to their lithium counterparts. We will explore the challenges associated with NIBs, such as lower energy density, limited cycling stability, and issues related to the performance of sodium-based electrode materials. Additionally, we will discuss advancements in anode and cathode materials, electrolyte systems, and innovations in sodium-ion configurations that address these challenges. The lecture will also highlight ongoing research efforts and potential future directions in the field, emphasizing the vital role of NIBs in achieving a more sustainable energy landscape. By equipping participants with a comprehensive overview of the key concepts and ongoing challenges, we aim to foster informed discussions about the future of sodium-ion battery technologies in large-scale energy storage and electric mobility applications.



Figure 1. Illustration of a Na-ion battery system [1]

References

[1] Jang-Yeon Hwang, Seung-Taek Myung, Yang-Kook Sun. Chem. Soc. Rev., 2017,46, 3529-3614