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Promising Materials for Beyond Lithium Ion Based Electrochemical Energy Storage Devices: Exploring The Next Energy Frontier

The ever-increasing demand for energy in day-to-day life thrives the world towards developing highly efficient, powerful energy storage devices. Since its commercialization by SONY in 1991, the lithium-ion batteries (LIBs) have revolutionized the energy sector and been used as a major power source in various portable electronic devices and electric cars. But in light of the concerns like availability, cost, safety of major raw materials like lithium, nickel, cobalt used in the LIBs, the quest for "beyond lithium-ion batteries"such as Zn- ion, K-ion, Na-ion, Al-ion, and proton ion-based devices have intensified. Considering the abundancy, low flammability and its three electron per cation redox electrochemistry leading to its high theoretical capacity, aluminium is gaining widespread popularity in the present-day energy research. The aluminium research primarily focuses on positive aluminium hosting electrode materials and the electrolyte system. Similarly, energy storage devices based on proton (H +) ion can also complement the existing nonlithium based energy storage devices due to the various appealing traits possessed by proton. But the research attempts in developing proper electrode materials have encountered various complications like lower cell discharge voltage, dissolution of the host materials, inadequate cycle life with capacity fading after several cycles. Herein a brief review on various most promising advanced electrode materials for aluminium and proton-based energy storage devices have been demonstrated along with the electrochemistry of a promising electrode material MnWO4 . Various strategies for capacity enhancement are also illustrated here.

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