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Zinc Ferrum energy storage chemistries with high efficiency and long cycling life

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Energy storage systems with higher energy density and good electrochemical performance are the urgent demand in new energy industry for electric vehicles. Rechargeable aqueous Zn-ion batteries (ZIBs) are particularly attractive owing to the safety, nontoxicity, inexpensiveness and high energy density. Here, we propose a new prototype of liquid Zn-Ferrum batteries (ZFBs) using metal Zinc as anode and aqueous Fe(II/III) redox couple as catholyte. This battery presents excellent electrochemical performance with the capacity of 352 mAh g^{-1} at an average discharge voltage up to 1.25 V, an energy density of 391 Wh kg^{-1}, a power density of 2.2 kW kg^{-1} at current density of 2 A g^{-1}, and long cycling life: No evident capacity fading after 5000 cycles. In the case of the ZFBs system, sub-nanometer pores of CF-N-O enable low self-discharge rate *via* Fe^{2+} and Fe^{3+} adsorption in carbon nanopores, which was achieved without applying an ion exchange membrane. It was testified as a promising energy storage system with high efficiency, energy density, reliability and durability, and it might be a promising application in electric vehicles.

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