High Performance Zn/LiFePO$_4$ Aqueous Rechargeable Battery for Large Scale Applications

In this work, a novel aqueous rechargeable battery Zn/LiCl-ZnCl$_2$/LiFePO$_4$ has been developed. The electrochemical performance of olivine LiFePO$_4$ positive electrode has been investigated in the structure of this battery. Along with a high (about 100%) coulombic efficiency, this electrode exhibited enhanced cycling performance at various current densities up to 60 C with the average operation voltage 1.2 V. A capacity of 92 mAh g$^{-1}$ was achieved over 400 cycles at a cycling rate 6 C, and exhibited a superior rate capability with the capacities of 72 mAh g$^{-1}$ at 30 C and 45 mAh g$^{-1}$ at 60 C, respectively. The battery temperature tolerance was first investigated, and it demonstrated a very stable cycling at a wide temperature range from -10 °C to 50 °C. A cylindrical battery with the capacity of 150 mAh was first designed using proposed configuration and successfully operated under 54 mA with high efficiency and capacity retention. Zn/LiFePO$_4$ battery offers an exceptionally safe, low cost, long cycling life, and high energy and power density energy storage for large-scale applications. (C) 2014 Elsevier Ltd. All rights reserved.