An investigation of the Zn dendritic growth in Zn//LiCl + $ZnCl_2$//$LiFePO_4$ rechargeable aqueous battery

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Aqueous rechargeable lithium-ion batteries (ARLBs) have appeared to be a promising candidate for increasing battery safety and reducing fabrication cost. One of such systems was published in 2015 [1], where zinc (Zn) foil had been chosen as a negative electrode due to its abundance in the Earth's crust and high theoretical capacity. However, Zn-based battery systems have a common serious issue arising from the Zn dendritic growth on the surface of the electrode after several cycles leading to shortened cycle life [2]. There are many approaches for suppression or elimination of Zn dendritic growth. In this work the dendrite suppression effect of three-dimensional (3D) Zn electrode was studied for the Zn//3M LiCl + 4M ZnCl2//LiFePO4 rechargeable aqueous battery system. A beaker cell consisting of Zn foil as counter/reference electrode and copper (Cu) foam (3D structure) as a substrate for working electrode separated by AGM was assembled [3]. The assembled beaker cell was charge/discharged at 20 C using VMP3 potentiostat/galvanostat (Bio-Logic). For comparison, one cell was assembled with Cu foil (2D structure) instead of the foam. From the obtained results it was observed that the cell with 2D electrode short-circuited after 12 cycles, while the cell with 3D electrode performed 150 cycles with a stable Coulombic efficiency (Fig. 29).

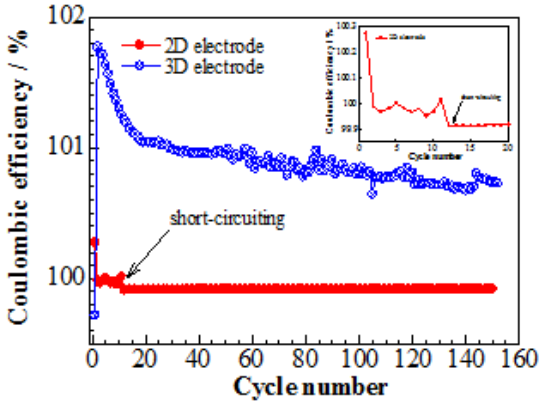

Fig. 29 Coulombic efficiency of the beaker cells with Cu foil and foam.

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