Effect of Different Additives on the Electrochemical Behaviour of Nickel Hydroxide Electrodes employed in Batteries

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Nickel hydroxide is widely used as the active material in positive electrodes in most nickel-based rechargeable alkaline batteries. The theoretical capacity of nickel hydroxide is 289 $mAhg^{-1}$. The capacity of these batteries depends on the specific capacity of the positive electrode and the utilization of the active material because of the positive electrode capacity limitation.

The poor conductivity of active material requires the addition of some additives to increase conductivity and, additionally, to increase the oxygen evolution potential, the charge efficiency and to inhibit the development of γ-NIOOH phase. Many studies have been published on nickel hydroxide with different additives to obtain optimum performance; for example: cobalt [1-2], carbonaceous materials [3], calcium [3], zinc [2] and nanomaterials [4]. In this work, we have studied the electrochemical behaviour of nickel hydroxide electrodes containing additives as: cobalt (by electroless technique), nanosized $Ni(OH)_2$ (by direct mix with active material) and MWCNTs (incorporated to active material during hydrothermal synthesis). Their electrochemical characterization was investigated by using cyclic voltammetry, charge-discharge cycling, and electrochemical impedance spectroscopy (EIS) techniques. The experimental EIS data are used to identify the model parameters by fitting the theoretical impedance function; this was derived from the physicochemical model based on the theory of porous electrodes with the charge/discharge processes occurring at the active material/electrolyte interface [5]. The results are found to be useful to determine the key factors responsible of the electrochemical performance of nickel hydroxide electrodes.

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