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SnO_2 as a cathode material for rechargeable Mg batteries

H.N.M. Sarangika[1, 2, 5*], G.K.R. Senadeera[1, 3], M.A.K.L. Dissanayake[1, 4, 5], K.V.L. Amarasinghe [5], W.A.R.B. Weerasekera [3] and V.A. Seneviratne [4]

[1]*Institute of Fundamental Studies, Kandy, Sri Lanka.*
[2]*Department of Physical Sciences and Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka*
[3]*Department of Physics, Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka*
[4]*Department of Physics, University of Peradeniya, Peradeniya, Sri Lanka*
[5]*Postgraduate Institute of Science, University of Peradeniya, Sri Lanka*

The energy demand is rapidly increasing with increasing global population. Therefore, supply of energy for the society is a major challenge to maintain a comfortable standard of living. Energy storage plays major role in achieving a sustainable energy system and advanced energy storage devices such as ion transfer batteries have become important in research and development work. Majority of current rechargeable battery technologies are directed towards developing Li battery systems due to their high specific energy density. Magnesium is positioned next to Lithium in the electrochemical series and therefore its electrochemical characteristics are comparable with neighbor Lithium. In the view of the natural abundance of Magnesium, their low cost, low molecular weight and safety, Mg rechargeable battery systems are considered to be one of the most suitable replacements for Li systems. In this study, we have explored the possibilities of using SnO_2 as the cathode martial in rechargeable magnesium batteries fabricated with Mg^{2+} ion conducting, quasi solid (gel) polymeric electrolyte based on polyethylene oxide (PEO) as the host matrix. Electrolyte was characterized by AC impedance spectroscopy, cyclic voltammetry (CV) and DC polarization method. The best ionic conductivity of the electrolyte was 2.52×10^{-3} S/cm at room temperature for the composition of PEO (12.20 wt%), $(CF_3SO_3)_2Mg$ (14.6 wt%), EC (36.6 wt%), PC (36.6 wt%). The estimated value of Mg^+ ion transference number and total ionic transference number are found to be 0.20 and 0.98 respectively. Fabricated batteries with cell configuration $Mg/PEO:EC:PC:Mg(CF_3SO_3)_2/SnO_2$ exhibited a discharge capacity of 220 mAh/g and 1.85 V open circuit voltage.

Key words: Mg Battery, Impedance spectroscopy, Polymeric electrolyte

*sarangikah@gmail.com