High Energy Density Magnesium Battery as a Post Lithium Battery for Electrical Energy Storage

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Meeting the requirements of electric vehicles era is a challenge of lithium ion batteries. In particular, safety, cost and high energy density have directed attention toward alternatives for lithium battery. Mg-ion battery possesses crucial merits as shown in Fig. 1. Practical rechargeable magnesium batteries have been hindered due to lack of efficient Mg electrolytes and relevant cathode materials. Herein, nonaqueous liquid electrolyte system based 2,2-Dimethoxypropane and magnesium nitrate hexahydrate MgN/DMP is synthesized via 'Solvent-in-Salt' method. This electrolyte exhibits high ionic conductivity (1.1 mS cm^{-1} at 25 ^{o}C) and Mg ion transport ~ 0.23. 2,2-Dimethoxypropane as a water scavenger can capture reducible molecules like H_2O and dehydrate $MgNO_3.6H_2O$. Meanwhile, Mg-NO_3 bond will become weak—something which frees up the mobility of Mg^{2+}. The electrochemical properties of Mg anode, operating in 1M MgN/DMP, were studied. The general aim of the investigation was to demonstrate a potential application of MgN/DMP electrolyte in a Mg-ion cell. Electrodes were analyzed with the use of cyclic voltammetry (CV), galvanostatic charging/discharging tests, and electrochemical impedance spectroscopy. A comparative study between different cathodes like MoS_2, MoS_2/Graphene nanoplatlets, V_2O_5, GeO_2, TiO_2, … and S using MgN/DMP electrolyte was performed.

References

[1] Sheha, E. et al., The electrical and electrochemical properties of graphene nanoplatelets modified $_{75}V_2O_5$–$_{25}P_2O_5$ glass as a promising anode material for lithium ion battery. *Journal of Alloys and Compounds*, 2018. **735**: p. 445-453.

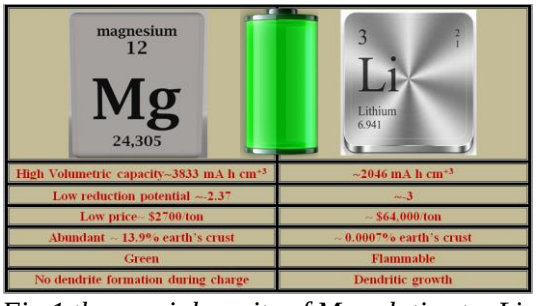

Fig.1 the crucial merits of Mg relative to Li electrodes

[2] Sheha, E, et al., Green synthesis of Co_3O_4/graphene nanocomposite as cathode for magnesium batteries. *Materials Science-Poland*, 2017. **35**(3): p. 528-533.

[3] Sheha E et al., Electrical and electrochemical properties of titanium dioxide/graphene nano platelets cathode for magnesium battery applications. *Ciência & Tecnologia dos Materiais*, 2016. **28**(2): p. 117-123.

[4] Sheha, E., et al., Effect of Magnesium Bromide on the Electrical and Electrochemical Properties of PVA and Tetraethylene Glycol Dimethyl Ether Polymer Electrolyte for Solid State Magnesium Batteries. *Energy and Environment Focus*, 2016. **5**(2): p. 125-130.