Development and Performance Evaluation of a New Type of Mg-Air-Battery for Emergency: The Teabag Model

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The Great East Japan Earthquake in 2011 caused disastrous damages in portable devices due to the lack of battery power supply. From the experience Mg-air-batteries have attracted attention for emergency use. In Mg-air-batteries magnesium is used as an anode, and oxygen as an active material on a cathode. It can generate electricity with use of easily available materials, by the reaction of magnesium and oxygen. However, structure and materials of Mg-air-batteries developed by school laboratories and companies are faulty and their performance was quite low. We aimed to develop a practical Mg-air-battery with a performance excellent for anti-disaster measures, and succeeded to develop a new model named The Teabag Model. For a separator we used a teabag made from cellulose in place of copper net used by conventional batteries because we found that generation of verdigris on copper net in the course of the cell reaction causes serious electric resistance. This improvement gave quite successful results. Experiments for the best condition revealed that saturated NH_4Cl solution is the best electrolytic solution. Furthermore, Mg-Ca alloys were more suitable than Mg metal to avoid formation of insoluble $Mg(OH)_2$ coating film. Performance evaluation experiments revealed that The Teabag Model is quite excellent as an anti-disaster battery as following point of views. 1) All parts except for the magnesium anode can be recycled. 2) Electric power value of The Teabag Model is more than 20 times as larger as Mgbox which is commercially available. 3) It has high capacity enough to recharge a smartphone.

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