Characterization of a Conductive Agar Electrolyte

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Abstract

Recent events highlighting potential dangers with lithium-based rechargeable systems have resulted in new motivation to find safer, greener alternative battery systems. In particular, new metal battery chemistries are receiving renewed attention including aluminum, iron, and magnesium.

Rechargeable iron-air batteries are a promising approach due to the abundance and low cost of iron in addition to its safety compared with other rechargeable battery chemistries. Iron-air batteries face two main challenges: an inefficient charging cycle due to hydrogen evolution and a low discharge rate due to iron (II) passivation. It is not uncommon for theses batteries to require overcharging by upwards of 100% to fully recharge. Previous work on iron-air batteries has shown that incorporation of bismuth can minimize hydrogen evolution in iron-air batteries.

We present here our results in developing gel-based electrodes for rechargeable iron-air batteries in aqueous electrolytes. The research here focuses on the characterization of an polyacrylamide/graphite and agarose/graphite gel electrodes for this purpose. These gels may be suitable for an iron-air anode matrix to increase the active area of the electrode. This paper presents findings showing the effects of gelling agent (polyacrylamide or agar) concentration, graphite concentration, temperature, and pH. Additional work showing the effects of bismuth to increase to hydrogen overpotential during charging will also be discussed.