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הפקולטה למדע והנדסה של חומרים

Department of Materials Science & Engineering

הטכניון מכון טכנולוגי לישראל

SEMINAR סמינר

Activation and Inhibition of Anodes for Metal-air Batteries

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The changing and expanding needs in the energy market, ranging from power grid energy storage system to portable power sources have necessitated the development of efficient, inexpensive and high performance battery systems. One of the promising avenues for achieving these goals is the development of metal–air batteries systems based on active metals, such as aluminum (Al) and zinc (Zn), which offer high energy densities and low cost.

However, metal–air batteries have to overcome some major challenges before they are widely commercialized. High corrosion rate of Al and Zn anodes in aqueous electrolytes impairs the functionality of the battery, due to a capacity loss, leakage leading to a reduced shelf life. One of the promising solutions to mitigate these metals corrosion is via an inhibition process. We developed an effective inhibition of aluminum and zinc corrosion in alkaline electrolytes. In a Zn-air battery configuration, it was found that a thermal pretreatment of Zn anode in alkaline solution containing inhibitors, reduces Zn corrosion rates tenfold. Hybrid organic/inorganic corrosion inhibitor was developed for alkaline Al-air batteries. The inhibition effect was studied with the use of electrochemical methods, microscopic, crystallographic and elemental analysis. It was found that the use of hybrid inhibitor system reduces Al corrosion by more than one order of magnitude, resulting in a dramatic increase in the Al-air battery capacity. Although the developed inhibitors significantly mitigated Al corrosion, the corrosion rate in alkaline solutions still remained prohibit high.

Thus, an initiative for a non-aqueous Al-air battery development had been taken, and the study reported here, is the first one disclosing an Al–air battery utilizing successfully a non-aqueous electrolyte. The battery configuration utilizes 1-ethyl-3-methylimidazolium oligo-fluoro-hydrogenate ($EMIm(HF)_{2.3}F$) room temperature ionic liquid (RTIL). The battery sustains current densities up to 1.5 mA/cm^2, producing a capacity of 140 mAh/cm^2 and thus, utilizing above 70% of the theoretical Al anode capacity. This is equivalent to outstanding energy densities of 2,300 Wh/Kg and 6,200 Wh/L.

Advisor: Prof. Yair Ein-Eli

ההרצאה תתקיים ביום ראשון, ה- 7 ביוני 2015 בשעה 14:30

באודיטוריום ע"ש דיוויד וואנג , קומה 3, בנין דליה מידן

The lecture will take place on Sunday, June 7th, 2015 at 14:30,

David Wang Auditorium, 3rd floor Dalia Maydan Bldg.

כיבוד קל יוגש לאחר הסמינר