Elucidation of Electrochemical Characteristics of Room-Temperature Li/FeS_2 Batteries

Jae-Won Choi[1,3], Jin-Kyu Kim[1,3], Jou-Hyeon Ahn[1,3], Jong-Uk Kim[3], Hyo-Jun Ahn[2,3], Tae-Hyun Nam[2,3], Ki-Won Kim[2,3], Kwon-Koo Cho[2,3], Kyu-Bong Cho[3]

[1]Department of Chemical Engineering
[2]Department of Metallurgical Materials Engineering
[3]ITRC for Energy Storage and Conversion
Gyeongsang National University
900, Gajwa-dong, Jinju 660-701, Korea

Pyrite (Iron disulfide) has been demonstrated to be very useful material for the development of electrodes used in lithium batteries. The abundance, non-toxicity, and high theoretical specific energy of the Li/FeS_2 couple (1273 Wh/kg based on $4e^-/FeS_2$) make the natural mineral, pyrite, a promising cathode material for lithium batteries [1].

Experimental lithium secondary cells with pyrite electrodes have presented excellent reversible specific energy density at high temperatures (400~450°C) or specific capacity at moderate temperatures (625 mAh/g at 135°C) [2]. However, lithium cells with pyrite electrodes tested at room-temperature have shown inadequate characteristics and poor cycling properties [3-5].

In this work, we have studied electrochemical properties of synthetic and natural pyrite composite electrodes at room temperature. FeS_2 composite electrodes (comprised of FeS_2, PVdF-HFP and carbon black) were characterized in a lithium cell at room temperature. The electrolyte used was $LiN(CF_3SO_2)_2$ in a solution of tetraglyme and 1,3-dioxolane (1 mol/L). The FeS_2 electrodes were characterized by SEM, XRD and electrochemical methods. For galvanostatic discharge/charge at a current rate of C/10 and between voltage limits of 2.6 and 1.1V, its discharge capacity up to 750mAh/g at the first cycle and about 350mAh/g at the 15th cycle are shown in Figure 1. The variation of interfacial resistances with storage time is also shown in Figure 2.

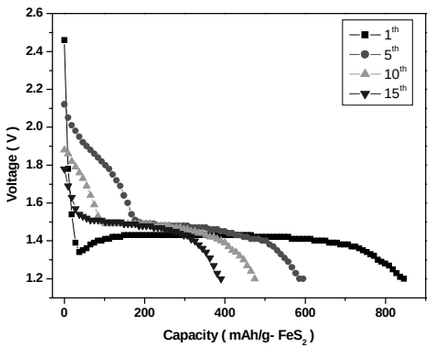

Figure 1. Discharge curves of the Li/FeS_2.

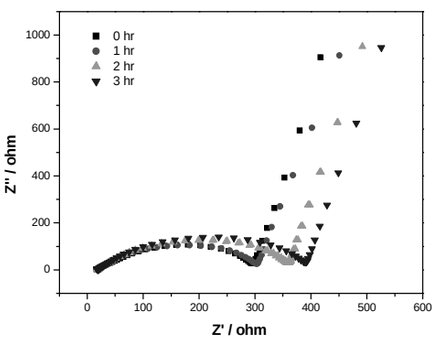

Figure 2. Interfacial resistances of Li/FeS_2 cell vs. storage time at RT.

References

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