

were subsequently tested in small-scale (3 in.) cells. Utilization of active materials in these small-scale cells have been obtained as a function of cell temperatures and discharge current densities. A typical result with LiCl-KCl-LiF (62.7-28.8-9.1 m/o, liquidus temperature = 397°C) shows 10% higher utilization at 450°C than that with the LiCl-rich electrolyte.

## Abstract No. 85

### Improvements in the LiAl/FeS Cell Design for the Mark IA EV Battery

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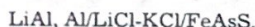
The 40 kW-hr Mark IA electric-vehicle battery was built by Eagle-Picher Industries under contract to Argonne National Laboratory. Cell performance goals were set at a peak specific power of 75 W/kg and a specific energy of 75 W-hr/kg at a 4 hr discharge rate after 60 cycles. A number of modifications were made to increase the initial specific energy and peak specific power to 100 W-hr/kg and 100 W/kg. Resistance mapping experiments and subsequent design modifications resulted in a 35% improvement of cell power. Modified electrolyte filling procedures alleviated cell short circuiting due to failure of the electrode edges to constrain the active material.

## Abstract No. 86

### The Electrochemical Reaction of Lithium with FeAsS

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The cathodic reaction of lithium with natural arsenopyrite, FeAsS, has been studied by coulometric titration at 400°C in the cell



Three constant voltage plateaus were found, probably corresponding to three 4-phase regions. Products have been identified by x-ray powder diffraction, and the results are discussed in terms of available thermodynamic data on this four-component system. Kinetics in this system appear to be rather fast, with rapid reaction of at least three lithiums per ion.

## Abstract No. 87

### Approach for Cost Effective Positive Electrode Current Collectors in the Lithium/Metal Sulfide Battery

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The boronization of low carbon steels for use as the positive electrode current collector of the Li/FeSx battery was investigated. Problems involving the loss of the iron boride coating was approached by an *in situ* method of replenishing the coating. This was done by observing the migration of boron from a discharged sample of active material containing either iron borides or elemental boron, to steel current collector substrate at 500°C in the presence of LiCl-KCl eutectic electrolyte.

## Abstract No. 88

### A Theoretical Analysis on the Model of Porous Gas Diffusion Electrode

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A theoretical discussion on the polarization of porous gas diffusion electrode considering the flooded catalytic agglomerates covered with nonuniform liquid film is presented. Electrochemical reaction, diffusion in gaseous phase, diffusion through liquid film and diffusion in agglomerates are considered simultaneously. The performances of the electrode can be predicted as functions of measurable electrode parameters—characteristic transport currents. Analytical solutions and digital simulations are given and compared with experimental results.

## Abstract No. 89

### Surface Analysis of Significant Interfaces in the Li(Si)/FeS<sub>2</sub> Battery System

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Previous combinations of electrochemical and surface analysis experiments have produced encouraging results in our understanding of important electrode interface compositions. We have extended these concepts to a study of the changes in interfacial cathode and anode compositions of the Li/metal sulfide battery system. Our preliminary results reported here correlate migration of cathode components such as sulfur, and anode components such as Li, as seen by electron microscopy and electron microprobe analysis with more controlled experiments involving the techniques of Auger, x-ray photoelectron spectroscopy and ion beam depth profiling. Correlations of certain features in the discharge of these batteries with unusual interfacial stoichiometry have been attempted.

## Abstract No. 90

### The Status of Pure Magnesium Anode in Seawater Activated Cells

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Results of investigations on magnesium anodes covering a range of compositions from pure magnesium through magnesium containing trace impurities, to magnesium alloys, in seawater activated cells using silver/silver chloride as cathodes are presented. Validity of assumptions made in recent work that pure magnesium forms more adherent and nonconductive sludge compared to certain alloy compositions is examined. Correlation of parameters like surface history, morphology, levels of impurities, and alloy compositions with performance characteristics is attempted.

## Abstract No. 91

### The Effect on Performance of Magnesium Alloy Composition and Battery Construction in the Lead Chloride-Magnesium System

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The effects of different magnesium alloys on voltage level, sludge formation, and hydrogen evolution in seawater-activated lead chloride-magnesium single cells were investigated. Compared with AZ61 alloy, alloys containing lead, thallium, or tin gave high voltages but large amounts of sludge, however, a magnesium/manganese alloy gave a higher voltage and less sludge. The characteristics of cells and batteries with varying numbers of cells containing this alloy were evaluated using battery constructions which minimized leakage losses. Energy densities of 143 W-hr<sup>-1</sup> and 92 W-hr<sup>-1</sup> were obtained.

## Abstract No. 92

### Atomic Structure Study of the PbO<sub>2</sub> Electrode

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Structural studies of tetragonal  $\beta$ -PbO<sub>2</sub> were carried out by Tolkachev using x-ray diffraction and by Leciejewicz and Padlo using neutron diffraction. The oxygen position in the structure could not be determined sufficiently well in the x-ray work, while in the neutron diffraction experiment only data up to  $\sin \theta/\lambda = 0.3$  were used and no temperature factors were introduced in the refinement. In view of these shortcomings, and as part of our program to correlate electrochemical activity of the positive active material of the lead acid battery with atomic structure, we have re-refined the structure of chemically prepared  $\beta$ -PbO<sub>2</sub> by neutron diffraction utilizing data up to  $2 \sin \theta/\lambda$  of 0.6.