discharge, give high energy densities (up to 2 Ah g^{-1}) in comparison with conventional inorganic battery depolarizers like MnO_2, HgO, CuO, AgO etc. Hence, it is worthwhile fabricating and studying the performance of a battery system combining magnesium and 2,4-dinitro phenol (DNP) using aqueous halide electrolytes like $MgCl_2$, $MgBr_2$ and $Mg(ClO_4)_2$. This poster describes the preparation of DNP cathodes after standardization of the cathode mixture. One volt, one Ah Mg/DNP cells were assembled using the above cathode in conjunction with AZ31 magnesium alloy anodes and discharged at current densities of 1.7, 3.3, 5.6 and 6.6 mA cm^{-2} in 2 M $MgCl_2$, $MgBr_2$ and $Mg(ClO_4)_2$. Cyclic voltammagrams of DNP were recorded in 2 M $Mg(ClO_4)_2$ at various sweep rates and concentrations in order to understand the reduction behaviour. This study suggests that DNP is a capable organic compound for use as cathode material in magnesium reserve batteries.

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P6

Rechargeability of natural manganese dioxide (NMD) modified by Bi_2O_3

F. Gorgulho *, Rosana Z. Domingues

University of Minas Gerais, Dept. of Chemistry, Av. Antonio Carlos 6627, 31270-901 Belo Horizonte, M.G. Brazil

C. Poinsignon

LEPMI-CNRS-INPG, BP75F-38402 Saint Martin d'heres, France

It has been reported in the literature that modified MnO_2 cathode materials containing bismuth allow multiple rechargeability over a two-electron capacity. All the reported researches are related to chemically or physically modified materials starting from high purity MnO_2 This work reports some results obtained with a natural manganese dioxide (NMD) with starting composition of 45% Mn, 15% Fe, 0.6% Si and 1.7% Al, which was modified by the addition of Bi_2O_3. X-ray diffractions show that this material has different crystallographic phases, among which pyrolusite is predominant. The reduction reversibility of NMD and NMD/Bi in 9 M KOH has been studied by slow scan voltammetry and constant current discharge and recharge. The results have shown good rechargeability and a discharge reaching 80–95% of the theoretical two-electron capacity in each cycle for the natural manganese dioxide modified by Bi_2O_3.

* Corresponding author

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P7

Investigation of the system: lithium accumulator and a battery of solar cells on a long-cycling regime

E.M. Shembel *, N.I. Globa, N.D. Zaderey and K.Y. Kilivnik

Ukrainian State Chemical Technology University, Dniepropetrovsk, Ukraine

The aim of this work was to study the combined influence of polarization characteristics of lithium accumulators and a battery of solar cells and the cycling characteristics of lithium accumulators when charged from batteries of solar cells (BSC).

Tests were carried out with lithium accumulators having operating voltages of 3.0 V (Li–MnO_2) and 4.0 V (Li–$LiMn_2O_4$). Manganese oxides, synthesized in our laboratory by different methods, were used as cathode materials. The lithium accumulators were made as both coin (2325) and spiral-wound (R 20 size) cells.

Changes in the internal resistance of the cells at different stages of cycling regime were calculated from impedance measurements taken in the frequency band: 0.2 Hz–200 kHz.

The investigations showed how the charging characteristics of the lithium accumulators depended on the conditions of BSC illumination, the characteristics of BSC, the electrochemical properties of the synthesized manganese oxides and the composition of the non-aqueous electrolyte.

* Corresponding author

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P8

Influence of the composition of non-aqueous polymer electrolytes on the characteristics of the electrode/electrolyte interface and the efficiency of their use in lithium accumulators

E.M. Shembel *, 1 O.V. Chervakov, L.I. Noduzhko, I.M. Maksyuta, N.I. Globa

Ukrainian State Chemical Technology University 320005 Dniepropetrovsk, Ukraine

D.T. Moshri

Advance Research Chemical, Inc., Catoosa, OK, USA

The aim of this work is to study the influence of the chemical nature of polymers, lithium salts and aprotic solvents on the conductance of non-aqueous electrolytes, on the interaction with electrode materials, system stability within a wide range of potential, and serviceability of lithium accumulators over long periods of cycling.

Two types of polymer-containing electrolytes were investigated.

(a) liquid non-aqueous electrolyte with up to 5% of polymer components, these being n-organosiloxane or n-silocrownester derivatives of poly-2-methyl-5-vinylpyridinium halides

(b) solid or gelatinous polymer electrolytes based on chlorinated polyvinylchloride.

The impedance characteristics of Li–Li, Li/MnO_2, $Li/LiMn_2O_4$, Li/FeS_2 systems have been studied. Mechanisms of the interaction of electrolyte components with electrode materials are proposed. X-ray diffraction and other supporting data on the polymers and solid electrolytes have been obtained.

In the case of type (a) electrolytes, it appears that the nature of functional groups present in the branches of polymer, the number of ionic groups present and the synthesis prehistory determine the impedance and characteristics of the systems.

The modification of the structure and composition of polyviny chloride by additional chlorination (chlorine content Increased from 56.7% to 60–72%) gives a decrease in the degree crystallinity of the system, and increases its elasticity. Accordingly, the properties of polymer electrolyte are improved significantly: system conductivity increases, the resistance of the passivating film on the lithium surface decreases and this means that the technological problems of fabrication lithium accumulators are solved efficiently.

The test results from samples of lithium accumulators with polymer electrolytes, containing either the 3.0 V Li/MnO_2 4.0 V $Li/LiMn_2O_4$ system will be displayed.

* Corresponding author

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P9

The practical, popular, battery powered car—the driving operational requirement for battery technology

Trevor Cave

Trevor Cave and Associates, Consultants to the Bluebird Project, PO Box 18649, London, NW3 2FY, U.K.

1. The problem

How many business executives would choose a battery powered, plastic bodied bubble car as the company car in preference to a 3-litre BMW? The public image of the electric car is poor, irrespective of environmental concerns. Like bicycling or organic crops, at best it is good for other people.

2. Present limitations

To overcome this image problem it would be easier for the marketeers if an electric car could replicate or surpass the performance of an internal combustion-engined car in all respects, rather than having to sell the ‘green image’ or rely on environmental legislation to force a change. So far, battery and electric automotive technologies in production has not achieved this. The Bluebird Electric LSR team aims to achieve a 300 mph speed record with an electric car. During the course of this project, it has been appropriate to estimate the degree of progress required in these technologies before electric cars can eclipse the i.c. engine.

3. The goal

The Operational Requirement is for a combination of batteries, motors and drive train to match or stirpass the i.c. power plant, fuel and transmission systems in all aspects—mass efficiency, power, noise, tractability, convenience-particularly of refuelling, service life, overall emission cycle and cost of ownership,

Comparison is made here between available i.c. automotive power systems and current and projected electric motor and battery technologies. A parametric comparison determines the performance envelope required of each—which is the Operational Requirement or O. R.

4. The O.R.

Comparison is made between available i.c. power systems and electric technology. A typical saloon car power train achieves 1.4 to 2.0 kW h kg^{-1}. The in-hub, brushless d.c. motors and gearbox technology used in Bluebird achieve 8–10 kW kg^{-1}, necessitating 1.8–2.1 kW h kg^{-1} batteries for an electric car to match i.c. performance. This is still highly demanding, even for fuel cells. Structural refinement to reduce this requirement would be available to i. c. also and cannot redress the balance entirely.

It appears, therefore that wholly new battery technologies are needed rather than incremental improvements to available systems. Spin-offs outside of the automotive field would include a 24-hour laptop computer life between battery charges, a week or more for a mobile phone, or ten cassettes in a camcorder—even portable microwave ovens. The market benefits for whoever introduces these technologies will be considerable.

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