

particular concern for the development of lithium accumulators. In this connection, it is very important to determine some of the dynamic characteristics of the lithium/non-aqueous electrolyte interface and to learn what governs these characteristics.

An equivalent circuit of systems studied is proposed. The parameters of the circuit were determined in different electrolytes by a grapho-analytical method based on impedance measurements. Experimental data were compared with the results of mathematical modelling of various equivalent circuits. The analysis carried out allows us to suggest the location of the growth zone of a passivating film and to a certain degree to predict a system's behaviour and its dynamic properties.

Changing the composition, volume and surface of binary and ternary lithium alloys allows us to change significantly the parameters of the passivating film, which affects both system storage and cycling efficiency.

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Lithium cobaltite. A supplier's point of view

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This paper reviews different aspects linked with the production of LiCoO_2 and its use as cathode material in secondary lithium batteries. As the electrochemical performances of LiCoO_2 are now well established, the poster focusses on other aspects that have been less addressed in the past.

Correlations between particle size, surface area and tap densities are presented. The influence of the conditions of synthesis and of the nature of the starting products on these properties are also discussed.

In a second part of the poster, economic aspects are reviewed. The structure of the cost of LiCoO_2 is shown and compared to that of other lithiated oxides.

Forecasts are given for total production, share of each type of oxide and market price.

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Analysis of lithium manganese oxide for lithium rechargeable batteries

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Introduction

Lithium manganese oxide (LiMn_2O_4) is the favoured cathode material in the long term for lithium rechargeable batteries because it can be produced from cheap and readily available starting materials and it is non-toxic. At present, lithium cobalt oxide is used in rechargeable lithium-ion batteries but is expensive and somewhat toxic. However the synthesis of LiMn_2O_4 , particularly in large quantities, is difficult to control, as there are many different chemical phases in the lithium/manganese/oxygen system. This led to difficulty in specifying LiMn_2O_4 , as nominally similar materials in practice show very different performance in batteries.

A programme of analyses has been carried out to characterise lithium manganese oxide using a range of techniques. Both commercial samples and materials we have synthesised have been analysed for lithium and manganese content by ICPAES (inductively coupled plasma atomic emission spectrometry), oxygen content by a LECO TC436 analyser and by thermogravimetric analysis. The valence state of manganese was determined by a titration method following reductive dissolution of iron (II) sulfate in sulfuric acid solution. X-ray diffraction patterns were used to monitor the presence of impurities.

Results

The results obtained indicate that samples of lithium manganese oxides prepared at lower temperatures are the so called oxygen-rich, defect spinel and those prepared at higher temperatures contain less oxygen and have formulae closer to those of the regular stoichiometric spinel. Furthermore, the LECO oxygen analyser gave poor results because this technique is only suitable for trace amounts of oxygen in alloys; the classical titration method gave better results for oxygen content. The average oxidation state of Mn in LiMn_2O_4 was found to be about 3.55 for samples examined. X-ray powder diffraction analyses of the prepared powders indicated a spinel structure with less impurities (LiMn_2O_4) at higher temperatures. The amount of these impurities appeared to increase with decrease in the calcining temperatures. In addition, the diffraction peaks were broader in the samples calcined at lower temperatures. Particle size characterisation of LiMn_2O_4 was carried out by a sieving technique and by a laser diffraction method. The results obtained by the two methods were very similar, but the spinel oxides calcined at higher temperatures have smaller surface area. The results discussed above are in agreement with previous findings, all relevant evidence for the above results being shown on the poster.

Conclusion

In summary it is difficult to control the reaction parameters such as uniform temperature, cooling time and oxygen flow