MATERIALS BASED IN $LiCoO_2$ DOPED BY ALKALI METALS FOR POSITIVE ELECTRODES OF SECONDARY LITHIUM BATTERIES

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Introduction

The importance of lithium secondary batteries is increasing permanently. One of the most commonly used materials for their positive electrode is the family of substances derived from $LiCoO_2$. According to our previous results, the properties of them can be improved by doping with alkali metals [1]. The aim of this contribution is the investigation of some properties of the $LiCoO_2$ containind superstoichiometric amount of lithium.

Experimental

Materials

The electrodes were prepared from $Li_{1.2}CoO_2$ prepared by a solid / state reaction of lithium carbonate and cobalt nitrate. Carbonaceous materials CHEZACARB A (Chemopetrol Litvínov Inc., Czech Republic) and chemically modified graphite (Bochemia Bohumín, Inc., Czech Republic) were added for improvement of electric conductivity. Suspension of PTFE (Dyneon TF 5035) served as a binder.

The electrolyte contained lithium perchlorate dissolved in a mixture of ethylene carbonate and diethyl carbonate (EC-DEC).
Procedure and accessories

The electrochemical properties were investigated by the use of a three / electrode wessel containing lithium counterelectrode and reference electrode. Potentiostat ECOCHEMIE - AUTOLAB and corresponding software GPES vas applied.

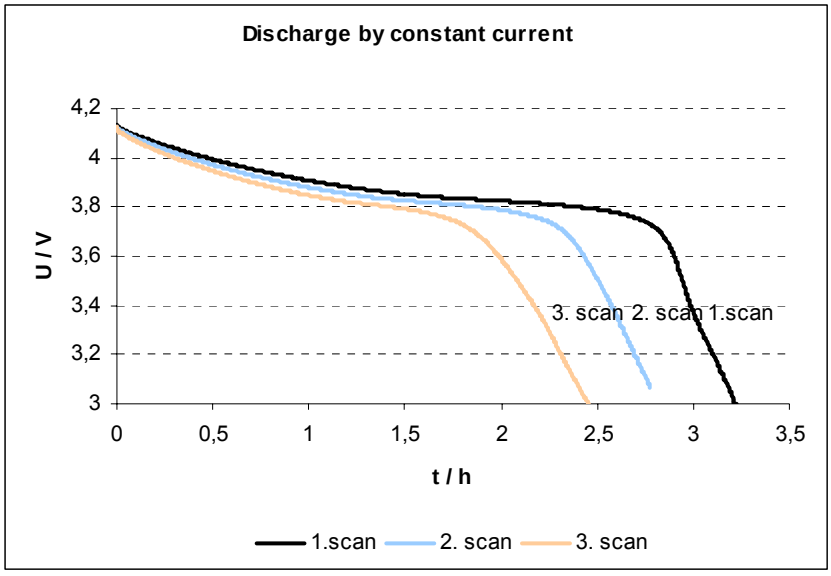
A routine was written for the software; it consisted of cycles in which the electrode was charget to +4.2 V potentioastatically and then discharged galvanostatically (current corresponded to 45 mA/g of active mass) down to the cell voltage +3.0 V. This cycle was repeated three times.

Results and discussion

The ratio between $Li_{1.2}CoO_2$ and other additives had to be optimized. As an example, the results obtained on one of the best results are given in here.

The electrode was prepared by mixing 75% $Li_{1.2}CoO2$, 10% carbon black, 10% graphite, 5% PTFE and spreading on a stainless screen

Scan	Q-/Q+ (-)	Utilisation of active mass (%)	Specific capacity (C/g)
1	0,79	52,64	390,19
2	0,86	46,14	342,00
3	0,86	40,23	298,20



Conclusions

The best results were obtained using material containing 75% $Li_{1.2}CoO_2$, 10% carbon black and 10% graphite. However, higher addition of electroconductive substances decreases the amount if the cobalt compounds and lowers the practical specific capacity of the electrode. The positive influence seems to be based in better current distribution to the grains of cobaltate and the total amount of added conductive carbon must be balanced with the decrease of electrode capacity.

Most likely, the main reason for performance improvement is better current distributioin in the electrode mass.

References

1. J. Bludská, J. Vondrák, I. Jakubec and P. Stopka, The Stabilization of $LiCoO_2$ by Cointercalated Sodium J. Power Sources 39, 313 (1992).