Solution Combustion Synthesis of Lithium Cobalt Oxide – Cathode Material for Lithium-Ion Batteries

Victor D. Zhuravlev¹, Anna V. Shikhovtseva², Larisa V. Ermakova¹, Elizaveta Yu. Evshchik^{2,*}, Elena A. Sherstobitova³, Dmitry V. Novikov⁴, Olga V. Bushkova^{1,2,3}, Yuri A. Dobrovolsky²

¹Institute of Solid State Chemistry, Ural Branch of the Russian Academy of Sciences, Ekaterinburg 620990, Russia

²Institute of Problems of Chemical Physics, Russian Academy of Sciences, Chernogolovka 142432, Moscow Region, Russia

³M.N. Mikheev Institute of Metal Physics, Ural Branch of the Russian Academy of Sciences, Ekaterinburg 620990, Russia

⁴InenergyLlc, Moscow 115201, Russia

*E-mail: liza@icp.ac.ru

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A simple but novel solution combustion synthesis (SCS) technique suitable for LiCoO₂ scale production was developed. Citric acid was used together with glycine to slow down the combustion rate; cobalt(II) nitrate was partially replaced with cobalt(II) carbonate hydroxide to reduce the heating of the off-gases using the excess heat of the redox reaction. As a result, no open flame or eruption of the powder product out of the reactor was observed; the rapid SCS process occurring in the desired non-turbulent mode is suitable for scaling. The influence of the ratios cobalt(II) nitrate/cobalt(II) carbonate hydroxide and glycine/citric acid on the LiCoO₂ powder product properties was examined along with the influence of the post-combustion annealing conditions and pH of the precursor solution. The thus-obtained LiCoO₂ powders were characterised by X-ray diffraction, scanning electron microscopy and particle size distribution analysis. Testing of the electrochemical behaviour of the LiCoO₂ powders was performed in Li/LiCoO₂ test cells having 1M LiDFOB in EC/DMC (1:1, wt.) as an electrolyte. The results confirmed the high electrochemical activity of the SCS-derived LiCoO₂ powders; the best samples exhibited a discharge capacity ≥ 150 mAh g⁻¹ and coulombic efficiency ≥ 99.5 % following 30 cycles at C/10 rate.

Keywords: lithium-ion batteries; lithium cobalt oxide; solution combustion synthesis.

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