

THE PREPARATION OF LANTHANUM NICKELATES BY THE COMPONENT COPRECIPITATION METHOD

The article is devoted to preparation and investigation of complex lanthanum nickelates related to Ruddlesden - Popper (RPP) phases of the total composition $La_{n-1}La_2Ni_nO_{3n+1}$ with $n=1$ ($La_2NiO_{4,17}$) and $n=2$ ($La_3Ni_2O_{7,02}$).

The purpose of the research was the investigation the optimal conditions for co-precipitation components of lanthanum nitrate and nickel solution K_2CO_3 , followed by study of thermolysis processes obtained coprecipitated batch.

The research was done with various ratios of the total metals concentration amount of to the precipitant (n), wherein n ratio was varied in each series of experiments from 0.5 to 12. After three days of retention, precipitates were filtered off, the residual concentration of metals and pH was determined in the filtrate. Best results are obtained using as the precipitant solution with the molar ratio of K_2CO_3 amount of deposited metal ion precipitant to $n = 1.75$ and $pH = 10-11$. It was determined that under these conditions at a $pH = 10-11$ the precipitation is performed to form a lanthanum nickel hydroxycarbonate of the total composition $La_nNi_m(OH)_{3n+2n-x}(CO_3)_{x2} \cdot tH_2O$ (wherein $n:m$ 2,00:1; 1,50:1; t – a variable of water content).

Simultaneous IR spectroscopic and thermogravimetric studies revealed that the decomposition of the air dry lanthanum nickelates batch takes place in several stages, namely, the liberation of the chemically bound water in the temperature range $150-170^\circ C$, carbon dioxide production with complete disruption of carbonate groups at a temperature ranging $490-520^\circ C$ chemical bond redistribution between lanthanum, nickel and oxygen and removal of residual carbon dioxide in the temperature range $520 \leq T \leq 885^\circ C$ (as indicated by the behavior of the IR spectra of the samples, comparisons with thermogravimetric studies). Later at temperatures $885-895^\circ C$ lanthanum nickelates are formed.

The oxygen stoichiometry of samples belonging to the RPP is $La_2NiO_{4,17}$ and $La_3Ni_2O_{7,02}$ was determined by iodometric titration. Accuracy of oxygen was $\pm 0,02$ per formula unit.

X-ray studies found that the compound $La_2NiO_{4,17}$ crystallizes in the tetragonal system with structural type K_2NiF_4 (space group $I4/mmm$) and lattice parameters $a=0,3843(2)nm$, $c=1,263(3)nm$. $La_3Ni_2O_{7,02}$ crystallizes in the orthorhombic space group $Fmmm$. The lattice parameters $a=0,5445(3)nm$, $b=0,5389(2)nm$, $c=2.52(4)nm$.

Key words: coprecipitation, Ruddlesden–Popper phases (RPP), lanthanum nickelates, oxygen nonstoichiometry.