



## CHANGES OF STEHIOMETRIC AND NONSTHEIOMETRIC NANOPOWDERS OF LITHIUM ORTHOSILICATE UNDER THERMAL TREATMENT AND ACTION OF MOISTURE

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### ABSTRACT

Nanopowders of  $\text{Li}_4\text{SiO}_4$  are very perspective materials as well sorbent of  $\text{CO}_2$  as well as fusion reactors tritium breeding material. Aim of the research was to determine changes of composition of stehiometric and nonstehiometric nanopowders of lithium orthosilicate under heat treatment and action of moisture on the ground of thermal gravimetric and x-ray diffraction analysis.

Nanopowders of  $\text{Li}_4\text{SiO}_4$  synthesized by plasma technology and protractedly holded at room temperature with moisture 10–12% contain 7% of  $\text{H}_2\text{O}$  and  $\text{CO}_2$ . Reflexes of  $\text{Li}_4\text{SiO}_4$ ,  $\text{LiOH}$ ,  $\text{Li}_2\text{SiO}_3$  and  $\text{Li}_2\text{CO}_3$  were observed in x-ray diffractograms of the stehiometric and nonstehiometric nanopowders. Both nanopowders of lithium orthosilicate were heated 2 h at  $600^\circ\text{C}$  temperature.

After thermal treatment of the nanopowders concentration of  $\text{CO}_2$  and  $\text{H}_2\text{O}$  decreases up to 1%. Only reflexes of  $\text{Li}_4\text{SiO}_4$  and  $\text{Li}_2\text{SiO}_3$  have been observed in the x-ray diffractograms. Curves of the thermal gravimetric analyses show that in air atmosphere  $\text{H}_2\text{O}$  of nanopowders desorbs at intervals of  $30\text{--}90^\circ\text{C}$  and  $250\text{--}300^\circ\text{C}$  temperature. At the temperature  $90\text{--}300^\circ\text{C}$  nanopowders absorbs extra  $\text{CO}_2$  that desorbs at temperature  $450\text{--}600^\circ\text{C}$ . Changes of structure of nanopowders have been investigated after 258 h action of 10.5 and 77.6 % of moisture at room temperature. At 10.5 % of moisture stehiometric nanopowders adsorbed 15% and nonstehiometric 11% of  $\text{CO}_2$  and  $\text{H}_2\text{O}$  both together. While at 77.6% moisture nanopowders absorbed 32% and 28% of  $\text{H}_2\text{O}$  and  $\text{CO}_2$ . Increasing of moisture increases concentration of  $\text{Li}_2\text{SiO}_3$ ,  $\text{LiOH}$  and  $\text{Li}_2\text{CO}_3$ , but reduces concentration of  $\text{Li}_4\text{SiO}_4$ .

Keywords: stehiometric  $\text{Li}_4\text{SiO}_4$  nanopowders, nonstehiometric  $\text{Li}_4\text{SiO}_4$  nanopowders, lithium orthosilicate, thermal treatment, moisture, thermal gravimetric analysis, x-ray diffraction analysis.