Influence of alloying elements on kinetics of the initial stage sintering of powders on the basis of yttrium stabilized zirconia

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Keywods: sientes, pressure, sintering.

Zirconia based materials attractive as a promising basis for the development of a matrix of ceramic materials of new generation.

Because bonding is one of the most important technological processes of ceramics from powders and playing a significant role in shaping the final properties of the material received, in addition to the influence of different alloying elements plays an important role in shaping the structural-phase condition and mechanical properties of the optimal choice of plays.

Baseline Nanopowders implemented method co-deposition of zirconium oxychloride reagent ($ZrOCl_2 \cdot nH_2O$), yttrium oxide (Y_2O_3), which acts as a stabilizer, $Al2O_3$, SiO_2, as alloying additions and 25% aqueous ammonia solution as precipitant. Powders for studies were synthesized in Donetsk Physico-Technical Institute. A.a. Galkin, "[1] to assess the quality of the received powder used BETH method (the method proposed by Brunaujerom, Emmett and Taylor), which gives an opportunity to estimate the surface area of the analyzed the powder and therefore rate the amount of grain from which directly affects the quality of spekaemoj ceramics.

Samples for sintering method received a uniaxial pressing in the form balochek with subsequent hydrostatic compression at kilobarah 3.

Conductivity method on the electronic dilatometre DIL 402 CP/4 (1600) of the firm "Netzch" kinetic patterns.

The intensity of the sintering processes are monitored on the curves on linear sintering shrinkage (dL/L) samples, which gives useful information about kinetics of sintering.

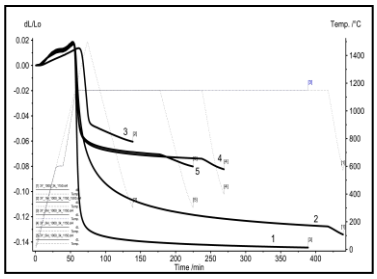

Fig.1. The dilatometric curves of sintering ZrO 2 -3% Y with and without addition of alloying of oxides: 1- ZrO_2 +3%Y+ 2% Al_2O_3; 2- ZrO_2 -3%Y; 3- ZrO_2 -3%Y+ 1% Al_2O_3; 4- ZrO_2 -3%Y- 3% Al_2O_3; 5-ZrO_2 -3%Y+ 5% Al_2O_3;

From Figure 1 it can be seen that the introduction of system ZrO_2 nanopowder +3% Y_2O3 alloying additives of aluminium oxide (Al2O3) in amount of 2mass% results not only significantly accelerate the shrinkage (dL/L) of the sample, but also to a greater magnitude of shrinkage compared to concentrations of 1, 3, 5% that entails obtaining ceramics with higher density and lower porosity.

In Fig. 2 the dilatometric curves represented nanopowder sintering system ZrO_2 +3% Y_2O_3 alloy additives of Silicon oxide (SiO_2).

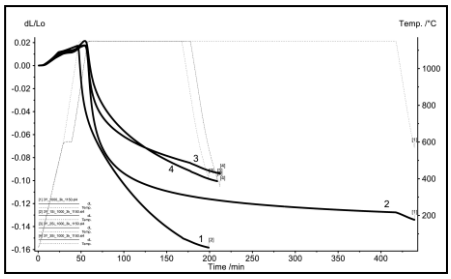

Fig. 2. Dilatometric curves of sintering Nano system ZrO 2 -3% Y with and without addition of alloying oxide SiO_2: 1- ZrO_2 -3%Y+ 1% SiO_2; 2- ZrO_2 -3%Y; 3- ZrO_2 -3%Y+ 2% SiO_2; 4- ZrO_2 -3%Y+ 3% SiO_2;

It is shown that in the heating mode to 1150^0C with sintering of ceramics goes differently, depending on the type of alloying additives and concentrations that are closely related to the influence of each of the additives on sintering process of nanopowders and allows thus regulate obtain ceramic materials with predictable mechanical properties of ceramics.

Analysis of the dilatometric curves of sintering samples with isothermal plot in the area of 1150^0C with of powders on the basis of a system of ZrO_2 and ZrO2 Y_2O_3−−$3Y_2O_3$ c additives Al_2O_3,and SiO_2 showed the influence of each on kinetics of alloying additions Pro the sintering process.

[1] I. Danilenko, T. Konstantinova, G. Volkova, *Nanoscale Research Letters* 2016, N11, P. 238-244