Nanocomposites and nanomaterials.

Influence of nanopowders obtaining methods and dopants on the sintering of zirconia based nanocomposites.

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Traditionally, technical ceramics prepared from the powder materials using various forming and sintering methods. In the development of modern methods of producing oxide materials, there are several trends: i) reduction of the grain size of the material; ii) developing methods of nanopowders synthesis; iii) activation of sintering by dopants addition. Yttria-stabilized zirconia (Y-TZP) has excellent mechanical properties, such as high fracture toughness, strength, and hardness, which widely used for different applications. The mechanical properties strongly depend on the microstructure of Y-TZP, which can be controlled by applying the sintering-acceleration effect of additives [1].

To develop a new Y-TZP ceramics with high quality and desired properties, which will be have excellent sintering characteristics, it is important to analyze the sintering mechanism of Y-TZP powder and to clarify the sintering-control factors. In this paper we investigated the influence methods of obtaining tetragonal zirconia nanopowders and some additives on sintering kinetics.

The powders were obtained by the technology which was developed in DIPE NAS Ukraine. The initial sintering stage was studied by a constant rate of heating (CRH) method at different heating rates [1]. Diffusion mechanism and the activation energy of sintering determined using equations derived Young and Cutler and Wang and Raj (Table 1).

Table 1. The order of diffusion mechanism and activation energies of sintering

Powders	n	Q (kJ/mol)
Tosoh TZ-3Y	1/3	840
Y-TZP (DIPE)	1/2	667
Y-TZP-2 wt % SnO_2	1/2	750
Y-TZP-2 wt % SiO_2	1	398

We found that a different method of production powders and various additives has a strong influence on sintering kinetics and mechanisms of mass transfer of zirconia nanopowders.

1. *Matsui K.,* Sintering Kinetics at Constant Rates of Heating: Mechanism of Silica-Enhanced Sintering of Fine Zirconia Powder // J. Am. Ceram. Soc. - 91 [8].- **2534–2539**.- 2008.