Nanocomposites and nanomaterials

The impact of TiO_2 and GeO_2 the sintering kinetics of tetragonal zirconia nanopowders

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Production of new zirconia ceramic materials with unknown unique properties is topical problem today. It is known that the problem can be solved by changing chemical composition (addition different additives to zirconia nanopowders) and using physical or mechanical impact [1-2]. It is really important to find methods of control the properties of ceramic based on zirconia microstructures by doping modifying additives or improving obtaining methods.

The sintering behavior of 3Y-TZP with and without a small amount (2 wt%) of TiO_2, GeO_2 and has been investigated using the dilatometric data and analytical method for determining the sintering mechanism [3].

It was shown the TiO_2, GeO_2 additives and the obtaining methods (co-precipitation and mechanical mixing) influence the sintering kinetics on initial sintering stage of tetragonal zirconia nanopowders. It has been found the different additives effected on phase composition, crystallite size and agglomeration degree of zirconia nanopowders in different way and can be the reason for the changing of sintering mechanisms. For example the TiO_2 additive which was added by co-precipitation leds to a change in the sintering mechanism from volume diffusion to the grain boundary diffusion while addition GeO_2 caused only the change in the activation energy of sintering processes. It has been shown the nanopowders which were obtained by mechanical mixing method were sintered due to the predominates of volume diffusion mechanism at the initial sintering stages. It was confirmed the volume diffusion mechanism is preferable for sintering of tetragonal zirconia nanopowders.

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