Nanocomposites and nanomaterials

The peculiarities of creation of zirconia based nanocomposites with addition of Al_2O_3 and NiO.

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The great limitation of ceramics application is its low fracture toughness. The focus studies of ceramic materials are improving resistance to crack propagation in the materials. Yttria-stabilized tetragonal zirconia (3Y-TZP) ceramic shows superior qualities compared to other materials, such as strength, toughness, hardness, and chemical stability [1]. "Transformation toughening" of zirconia is an outstanding method of enhancing of fracture toughness of zirconia-reinforced composites. However, phase transformation can lead to negative results, including a loss of surface integrity. This effect often limits application of zirconia ceramic in orthopedic [2] and wear devices [1]. So, increasing the fracture toughness of zirconia ceramics should be ensuring by crack deflection and crack bridging processes in composite structure.

Development of different types of composites is one widely-studied approach. Inclusions may be brittle, such as alumina particles, silicon carbide, and mullite whiskers, or ductile metallic particles such as nickel, iron, and silver. But in concrete case the formation of composite material – matrix and inclusion grains can take place by different ways in dependence from initial powder, compaction and sintering conditions.

In this study, we investigated the effect of nanopowder synthesis methods and dopant concentration on the structure and mechanical properties of 3Y-TZP/ alumina and 3Y-TZP/NiO ceramic composites and discuss the mechanisms of composite structure formation and they influence on composite toughening.

1. *Hannik R., Kelly P., Muddle B.* Transformation Toughening in Zirconia-containing Ceramics // J Am Ceram Soc. – 2000. – **83.** –P. 461-487.
2. *Naglieri V., Palmero P., Montanaro L., Chevalier J.* Elaboration of Alumina-Zirconia Composites: Role of the Zirconia Content on the Microstructure and Mechanical Properties // Materials. – 2013. – **6**. – P. 2090-2102.