("Nanotechnology and nanomaterials")

Influence of nanostructured PSZ modifier on structure and properties of Ceramics from industrial alumina powder

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Development of constructional and insulating ceramics based on refractory oxides with improved performance characteristics remains in sight of scientists and engineers, because it has the important combination of properties. One possible way to increase its hardness and durability is the use of ultradispersed powders and fibers, allowing due to their high activity to get dense and porous materials with high performance. However, the thermal resistance of industrial corundum is low, it has a high brittleness. To create more perfect structure and improve mechanical properties of this material it is possible to add into the powder of various reinforcing additives or use expensive new technology for consolidation of ceramics.

In connection with the foregoing the objective of the present work was to investigate the influence of PSZ modifier on the phase composition, microstructure and mechanical properties of composite ceramic material, produced from commercial powders of corundum.

Ceramics samples were prepared from industrial micron powder of corundum with the addition of reactive fibrous nanostructured powder partially stabilized zirconia (PSZ). The billets were obtained by static pressing with subsequent annealing at the 1600 – 1700^{o}C. The use of nanosized powders of dioxide of zirconium allowed not only to reduce the sintering temperature of the material, but to rise a bending strength in 1,5 - 2,0 times than ceramics from pure micron alumina powder.

As shown by the study of the microstructure of the modified alumina ceramics, the zirconia nanoparticles were located in the slot-like pores between micron corundum particles and caused the formation of a regular α-Al_2O_3 lamellar structure in the matrix. The PSZ nanoparticles not only mechanically filled the pore space, but created an intermediate layer on the surface of large corundum particles, which, at the pressure on the material, facilitated the sliding of the particles relative to each other, thereby increasing the coefficient of viscous destruction of Klc.