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Smart materials in the SiAlON-SiC-Al_2O_3 system

Z Kovziridze, N Nijaradze, G Tabatadze, N Darakhvelidze and Z Mestvirishvili
Georgian Technical University, Georgia

Purpose: In the present paper SiAlON-containing nano-composite was obtained through alum-thermal and nitrogen process on the base of geopolymer (Ukraine), aluminum nano-powder, silicium, aluminum oxide, silicon carbide with little admixes of yttrium oxide, magnesium oxide and glass perlite (Aragac, Armenia).

Methods: Composite was obtained in the nitrogen medium, by the reactive baking method at 1450°C. The advantage of this method is that compounds, which are newly formed thanks to interaction going on at thermal treatment: Si_3N_4, Si and AlN reactive which contributes to SiAlON formation at relatively low temperature, at 1300-1350°C. It is evident that inculcation of α - Al_2O_3 and ALN in crystal skeleton of ß-Si_3N_4 is easier since at this temperature interval crystal skeleton of Si_3N_4 is still in the process of formation. It should also be stated that strength and wear resistance of SiAlONs increase in their presence in silicium carbamide- and corundum -containing composites. The paper offers processes of formation of SiC-SiAlON and Al_2O_3-SiAlON and ß-SiAlON composites and describes their physical and technical properties.

Results: Open porosity of the obtained materials equaled to 15-16 %. Materials consisted of only SiAlONs. To receive compact materials the composites were grinded in planetary mill for eight hours, then they was cleaned from admixtures and the obtained powder was hotly pressed at 1750^0C under 25 MPa. Standing time at final temperature equaled to seven min. The results of samples testing: Density, g/cm^3=3.24; Thermal expansion coefficient, 1/grad 10^{-6}(800)=2.7-3.0; Hardness, HRA=94, HV=18 GPa; Flexural Strength, 500-550 MPa. Phase composition of the composites was studied by X-ray diffraction method, while the structure was studied by the use of optic and electron microscope.

Conclusion: Obtained materials are used in protecting jackets of thermo couples used for melted metal temperature measuring (18-20 measuring) and for constructions used for placing objects in factory furnaces, and for cutting ceramics.

Biography

Zviad Kovziridze is the Head of the Department of the technology of composite materials and articles of Georgian Technical University; Scientific supervisor of the center of bio-nanoceramics and nanocomposites material science of GTU. He is the Member of the Council of International Ceramists Federation (ICF); Member of the Council of European ceramists' Association (ECERS). He is also President of Georgian Ceramic Association and Editor-in-chief of journal *"Ceramic" of the Georgian Ceramists Association, "Journal of Ceramic Science and Technology"*. He has 168 publications in repute journals, among them 4 textbook, 7 monograph and 13 author's certificates.

kowsiri@gtu.ge

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