11TH CONFERENCE
FOR YOUNG SCIENTISTS IN CERAMICS

Satellite event:
ESR COST IC1208 Workshop

BOOK OF ABSTRACTS

October 21-24, 2105
Faculty of Technology
Novi Sad, Serbia

around 600–700 °C. However, such low temperature is not suitable for singly doped-ceria operations, as SOFC's electrolyte material has a high resistance. Structural modification of ceria solid solutions is one possible ways to improve their electrical conductivity.

The objective of this work is to investigate the phase relations in the binary system CeO_2-DyO_3 at 1500 °C in air in the whole concentration range. Powders of $CeO(NO_3)_2$ and Dy_2O_3 (99.99 %) were used as raw materials. The samples were prepared in steps 5 mol% from nitrate solutions with their subsequent evaporation and decomposition at 1000 °C for 2 h. Thermal treatment of as-prepared samples was carried out in to stages: at 1100 °C (452 h) and then at 1500 °C (150 h) in the furnaces with heating elements based on Fecral (H23U5T) and Supercantal ($MoSi_2$), respectively. The heating rate was 3.5 °C/min. The phase composition of the samples was investigated by X-ray (DRON-1.5, Burevestnik, Leningrad), petrographic (MIN-8, optical microscope, LOMO, Leningrad).

The study of solid state reaction of CeO_2 (fluorite-type, F) and Dy_2O_3 (cubic modification of rare-earth oxides, type C) at 1500 °C showed that two types of solid solutions based on cubic modifications of F-CeO_2 and C-Dy_2O_3 in the CeO_2-Dy_2O_3 system. These solid solution regimes were separated from end to end with the two-phase field: (F+C).

The boundaries of the homogeneity fields for the solid solutions based on F-CeO_2 and C-Er_2O_3, as well as lattice parameters of the unit cells for solid solutions F-CeO_2 and C-Er_2O_3 were determined. The solubility of Dy_2O_3 in F- modification of CeO_2 is about 20 mol % at 1500 °C. The lattice parameter of the unit cell decreased from $a = 0.5409$ nm in pure CeO_2 to $a = 0.5398$ nm for the solid solution of boundary composition. The solubility of CeO_2 in cubic C- erbium oxide attain ~10 mol%. The lattice parameters of the unit cell C phase varies from $a = 1.065$ nm in pure Dy_2O_3 to $a = 1.066$ nm for the solid solution of boundary composition.

Acknowledgement: This work has been funded by project (AFOSR) STCU P513 (2012-2014).

C26

FEATURES OF THE STRUCTURE AND PROPERTIES OF CERAMIC COMPOSITE B_4C–EUTECTIC ALLOY (B_4C-TiB_2) SYSTEM

M. Marych, I. Bogomol, P. Loboda, G. Bagliuk, H. Borodianska, O. Vasylkiv

National Technical University of Ukraine «KPI»,
Frantsevich Institute for Problems of Materials Science NAS Ukraine, Kiev, Ukraine

In this paper by combination of methods of crucibleless zone melting and spark plasma sintering (SPS) was obtained a new polycrystalline ceramic composite material of B_4C–E(B_4C-TiB_2) system. For its production were developed eutectic powders B_4C-TiB_2 with modified surface morphology, which mixed with the boron carbide powder and compacting by SPS. The unique surface morphology is that the reinforcement fiber and plate TiB_2 appear on the surface of each particle (Fig. 1), creating the effect of

traction. SPS was conducted in an atmosphere of nitrogen and argon. The relative density of the samples after sintering was 98 %.

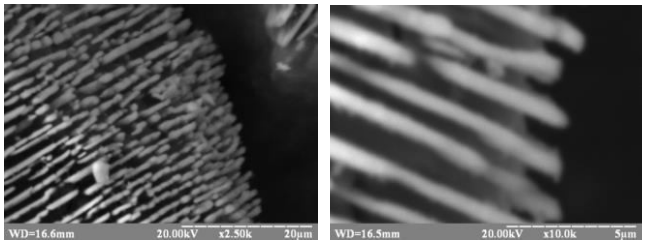

Figure. 1 Surface morphology of eutectic powders of B_4C-TiB_2 system

The microstructure of the composite is a matrix of boron carbide and evenly distributed in the matrix of eutectic grains. The grains boundaries of in the sintered samples are the perfect joints eutectic grains without visible defects and pores that may indicate their relatively high strength.

This composite showed sufficiently high mechanical properties. Bending strength at room temperature reaches 387.2 MPa, which exceeds the strength of directionally solidification eutectic alloy B_4C-TiB_2 (190 MPa) in 2 times. Bending strength at 1600 °C respectively amounted to 399.8 MPa. The unique morphology of the particle surface can increase adhesion eutectic powder B_4C-TiB_2 with matrix B_4C. By the results of X-ray diffraction and Electron studies it is no interactions between the matrix and eutectic grains are observed. This fact indicates good grip of eutectic grains with matrix and indicates an increase of flexural strength due to increase content of eutectic grains in the material. The strength of composites of B_4C–E(B_4C-TiB_2) sintered in a nitrogen atmosphere is up to 16 % higher than strength of samples sintered in argon atmosphere, that can explain by the formation of nitride phases, creating the effect of rigidity.