Description for the general public

Increasing development of industry still creates the need for new, innovative materials. Therefore today a lot of attention is given to composite materials. Among the ceramic materials the corundum is the most commonly used at present. This is mainly due to the availability of the material and its properties such as wear resistance, high temperature stability, high hardness or chemical resistance. In order to improve the fracture toughness the various type of alumina matrix composites are formed: through the introducing into the ceramic matrix a metallic phase as well as by the addition of a second ceramic phase. Homogenous dispersion of secondary phases in alumina matrix is a critical factor for achieving optimum mechanical properties in alumina matrix composites. Moreover it was recently reported that addition of additional phase significantly retards grain growth of alumina matrix. This may result in an increase in fracture toughness.

Because of the continuous search for materials with new properties in the literature more and more reports are about the ceramic matrix composites with functional gradient (FGM). This is a particular group of composites in which another phase is disposed in a specific way in a whole volume of material. Gradient materials with the ceramic matrix are produced by various methods such as infiltration processes, sedimentation of slurries tape casting in-situ (e.g. SHS) or centrifugal slip casting. A fundamental problem in the design of the functional gradient material is to control the gradient that, the change of amount the second phase along a selected direction within the ceramic matrix.

The aim of the project is therefore, to gain new knowledge about the impact of process parameters on structure and properties of functionally gradient materials from the ceramic-metal composites (Al_2O_3-Ni) obtained as a result of innovative technique such as centrifugal slip casting with the use of the magnetic field. Author of the project decided to combine the centrifugal slip casting method and magnetic field to create a new graded material with innovative properties that are a combination of favorable properties of each component. The project will be carried out to develop methods for the preparation of composite materials from the system Al_2O_3-Ni (with Al_2O_3 matrix) with the functional gradient obtained by centrifugal slip casting with the use of the magnetic field. It is planned to produce samples in the form of hollow cylinder with variable chemical composition of the cross-section of sample. Composites will be characterized by high hardness on the inner side of surface, a higher fracture toughness and high mechanical strength on the outer side of surface. The properties of the composites will be compared to known properties of composites obtained by other methods.