

## **Optimization of fracture toughness of ceramics composites: experimental study and numerical simulations**

Initiative: Trilaterale Partnerschaften – Kooperationsvorhaben zwischen Wissenschaftler(inne)n aus der  
Ukraine, Russland und Deutschland

Bewilligung: 28.02.2016

Laufzeit: 2 Jahre

The goal of the project is the experimental and numerical study of composite ceramics with the aim of optimizing their exploitation properties. As a practical result, recommendations will be given on the optimal method for the production of composite ceramics with high levels of fracture toughness. Based on original analytical and numerical calculations the crack propagation will be predicted in ceramic materials, having different phase, chemical and grading composition. The comparison of simulation results for materials with different distributions of the atoms due to the production of ceramics composite will allow to draw conclusions on the evolution (redistribution, diffusion) of small admixture in the structure of the matrix material. Special attention will be paid to the porosity and its influence on fracture toughness. By close interaction of the scientists from Germany and Russia, models of fracture of ceramic composites will be elaborated in the framework of the finite element method, the boundary element method and the method of cellular automata, from which the fracture toughness will be derived and predicted. Basic experimental testing, carried out in Kiev will be numerically simulated in working groups in Stuttgart and Tomsk. Four point bending tests will be performed for the definition of flexural strength, nanoindentation tests will be simulated within the framework of the finite element method with the application of the cohesive Zone model and the XFEM method. The results will be related to the experiments performed. The fracture toughness obtained from the indentation method will be compared with the results obtained in Tomsk using the new method of fracture toughness definition with chevron notch specimens. The investigations undertaken will provide the enhancement of the technological process of the production of ceramic composites with predefined properties.

### **Projektbeteiligte**

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**Open Access-Publikationen**

**The peculiarities of Structure Formation and Properties of Zirconia-Based Nanocomposites with Addition of Al<sub>2</sub>O<sub>3</sub> and NiO,**  
**Handbook of Mechanics of Materials**