**DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)**

Modern Ceramic Matrix Composites (CMCs) are a preferable choice, wherever an extreme mechanical and thermal resistance is a must. Elements of spaceships, jet propulsion engines, armor, machining equipment – are some of the possible applications to be mentioned. Generally invisible to the user, remain for years the driving force of progress in many areas of technology, effectively displacing metals and alloys.

Their complex internal structure has been well examined over the past decades by an emerging science – material engineering, thanks to the latest testing techniques. However, a continuous search for new materials for the more daring applications demands a deeper understanding of the micro- and nanoscale phenomena.

In most cases one of the key design criterions for CMCs is high impact resistance, that often involves foreign object damage. The design of these elements was based on a set of experimentally determined parameters, that were completely unrelated to material's internal structure. This approach was not only inefficient – as it discards the results of chemistry and material science but also inconvenient – as it provides only fragmentary feedback about the applicability of a material for a certain field. Hence the search for new material structures was conducted separately from the design of components and devices.

The goal of the project is numerical modelling of CMCs that will allow to reliably predict the dynamic response of a material during design process, relying only on its microstructure and a minimal testing in the lab. This model will certainly help to identify the sources of microstructural failure and thus provide a right direction for the research in the field of optimal composites.

The proposed research aims to combine the latest achievements of computational science with well-established methods of dynamic testing in the lab. Additional microscopic observations will deliver the necessary data about material's microstructure, grain morphology, ongoing damage and cracking processes. The key stage of the project is developing a homogenization algorithm that links microstructural strains to the overall material properties. In the future, this approach can be easily extended to new and emerging materials.

The project will contribute to a better utilization of recent achievements in material science for continuum and fracture mechanics. Closer cooperation between these fields is indispensable these days to maintain this astonishing progress of modern construction materials.