Discipline: information and communication technology/ mechanical engineering

Dynamic analysis of composite materials

Ceramic composites are used in industry in areas such as aviation, armaments, automotive, construction of nuclear power plants and the space industry.
Composites are materials subject to extreme loads such as variable dynamic loads, impacts or high temperatures.
Numerical models of materials with complex internal structures will be constructed. The interaction between the material phases will be investigated. The finite element method, peridynamics, and molecular dynamics simulations will be used.
The analyzes will be conducted using HPC (High Performance Computing) computers. Computer implementation of selected material models will be made. As part of the subsequent doctoral thesis, impacts will be modeled and the load-bearing capacity of samples, their fracture, and fragmentation will be assessed. The results of numerical analyzes will be compared with experimental results.

Figure 1 shows some results of finite element and peridynamics simulations.

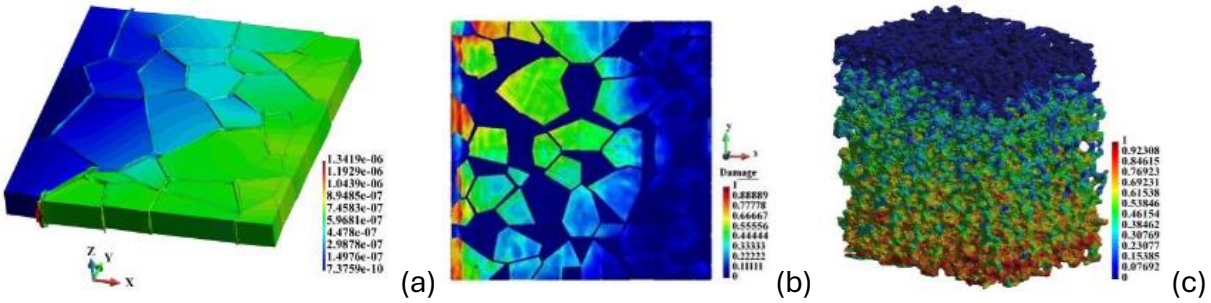

Fig. 1. Deformation of the WC/Co composite after impact (a) Damage of the Al2O3 phase in the ZrO2/Al2O3 composite (b) The extent of destruction of the Al2O3-infiltrated composite frame (c)

Of particular interest will be the influence of the properties of transition phases between different materials on overall load-bearing capacity of the material. We will study these problems using methods appropriate to the atomic level.

Selected papers:

1. Postek E., Sadowski T., Thermomechanical effects during impact testing of WC/Co composite material, Composite Structures, DOI: 10.1016/j.compstruct.2020.112054, Vol.241, pp.1-25, 2020. http://www.ippt.pan.pl/Repository/protected/p6784.pdf
2. Postek E., Pęcherski R., Nowak Z., Peridynamic simulation of crushing processes in copper open-cell foam, Archives of Metallurgy and Materials, Vol. 64, No. 4, pp. 1603-1610, 2019. DOI: 10.24425/amm.2019.130133 https://www.ippt.pan.pl/Repository/o6598.pdf

Required education: polytechnic/university.

If you are interested, please contact us by e-mail or telephone.

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