The Project under title:**„Experimental study of failure of structures built of functionally graded material"** is targeted at the experimental and numerical study on a behavior of thin-walled structures built of functionally graded material. Considered open thin-walled C-profiles columns/beams for the study will be subjected to simply mechanical loads: bending or compression and compression due to the presence of uniform temperature field. The essential goal of the proposed project is to elaborate the research methodology determining different states of the beam work (pre- and post-buckling state) until the moment of reaching the total load causing the damage (load-capacity). On the basis of the experimental results will be possible the validation and a comparison of results of numerical calculation obtained by means of finite element method (Ansys software). In addition, thanks to numerical analyses will be the opportunity to work out/definite the failure criteria for functionally graded materials considered within this project.

The predicted studies will be successfully carried out, beginning from preparing flat specimens assigned for determining basic mechanical and thermal properties. The determination of Young moduli and full material characteristics of fundamental components and materials being the mixture of those components will be determined on the basis of tension and bending test or by the use of indentation method (pressing indenter into material with registering the force). The expansion coefficients for simply specimens will be determined in thermal chamber. In the next stage, functionally graded material beams of different material configuration will be prepared. Initially, the galvanic methods of manufacturing samples are considered. For those samples, apart from elementary studies are foreseen microscopic analyses for the purpose of determining real composition of materials towards the wall thickness. The performance of study on columns/beams will be carried out on strength machine INSTRON with use of designed and produced grips to ensure appropriate supports during each test. In completion of experimental results, strains and displacements will be recorded by a means of non-contact optical system *ARAMIS*. This device will provide to collect maps of the specimens deformations up to 100/sec. The study of beams behavior due to compression induced by elevated temperature will be possible thanks to application of thermal chamber allowing to reach the temperature 300 $^{\circ}$C, at least. Study on the beams with the use of thermal-mechanic loads is considered within this project. One can assume introducing the initial pre-stressing of structure under adequate pressure and subjected to rising temperature field. In abbreviation, described study predicted in this project will enable to conduct the experimental analysis of total failure phase of thin-walled structures made of functionally graded materials. In this same time, during performing tests on beams, a series of numerical calculations regarding full materials characteristics and real material distributions in whole volume of structure for better finding the common denominator of both studies.

The reason to apply for this research project is first of all the continuance of the subject-matter previously finished project NCN concerning functionally graded material within only the dynamic simulations and pure theoretical calculations. Observing and analysing the accessible literature, it is hard to find works especially devoted to empirical studies over functionally graded materials assigned to failure analysis. The latest years, only a few researchers took up to challenge to investigate functionally graded materials with regard to their strength. In addition, owing to the fact that project's authors possess quietly a great experience in conducting of simulations and numerical calculations with the use of commercial software as well elaborating own programmes and skills in performing empirically the failure of structures especially built of multilayer fiber composite, it is purposeful to undertake the challenge to supervise the samples preparation and conducting research into graded materials which with respect to their properties and capabilities become more and more desirable for a work in hard conditions. In authors' opinion, the validation of numerical models of thin-walled structures made of functionally graded material with the results for real specimens and acquiring the fundamental knowledge of failure of FGMs will be having a great impact on scientific discipline.