DESCRIPTION FOR THE GENERAL PUBLIC

Fiber Metal Laminates (FML) are relatively new kind of materials. They are made of adhesively bound layers of metal and fibrous polymeric composite. FML's are characterized by beneficial utility properties e.g. high durability to density factor, excellent fatigue resistance and high resistance to low-velocity impact.

The bridging effect is a stresses transfer from the fatigue cracked metal layer of FML laminate to the metal intact composite fibers. The efficiency of bridging effect is dependent of the stress level which are transferring from the cracked metal layers to the intact fibers. According to the linear theory of elasticity, the higher is the Young's modulus of composite layer (in the longitudinal direction) in the FML laminate, than the greater is a stress transferred to the fiber via the bridging effect for a specified tensile strain. So on, the fatigue crack growth rate of the metal layer is reduced, which results in significant improvements in fatigue resistance of FML laminates compared to monolithic metals.

In the proposed project it will be researched, how will the bridging effect behave, when the composite layer of FML laminate will be built from different types of fibers, featured by different stiffness. It will be determined, if the global composite layer stiffness is crucial for the bridging effect efficiency, or perhaps the most important is the stiffness of the layer directly adjacent to the metal part. Undertaking studies to describe the process of fatigue cracking in hybrid laminates FML is justified in terms of the development of the scientific basis as well as in terms of broadening the possibility for introducing these materials to technology.

The scientific aim of proposed project is to verify the applicability of the existing models of bridging effect and if necessary, to enhance or modify current models to fit into the new type of hybrid FML, which are built from more than two different components. Bridging effect is a key factor influencing the fatigue durability of FML. Therefore, it is necessary to investigate the relationship between composite material properties, their layup configuration, and thickness of each material layer on the efficiency of bridging effect in hybrid FML and their fatigue crack propagation.

The experimental tests of fatigue crack growth rate of metal layer, as well as delamination growth rate of classic and new, hybrid FML. In addition, the experimental procedures will be supported by the numerical analyses of bridging effect by application of finite element method.