

Description for general public

The idea of the project is based on the use of the synergy of the metallic glass matrix and nanostructured solid lubricants, thanks to the use of a unique cold spraying method. The scientific goal of the project is to explain the phenomena occurring during the spraying process of Fe-based metallic glass coatings with incorporated solid lubricant particles, as well as to investigate the friction and wear processes in the coatings created in this way. An analysis of the influence of the substrate (Al alloy and stainless steel) on the adhesion of the coating, explanation of phenomenon occurring at the coating/substrate interface, mechanical and tribological properties of the obtained systems will also be carried out. This is important because the possibility of using coatings in specific operating conditions depends on the substrate used, e.g. where low mass of elements is required (aviation industry) or the ability to work at elevated temperatures. The application objective of the project is to improve the performing properties of kinematic pairs in terms of lowering friction and increasing durability at higher loads.

The concept of cold sprayed coatings from amorphous powders and a mixture of amorphous and nanostructured solid lubricant powders planned in the project creates new possibilities for deposition metallic glass coatings with high mechanical properties, tribological properties and wear resistance. The identified microstructure features correlated with the mechanical and tribological properties will enable the prediction of the behaviour of coatings during practical applications. In addition, for the first time, composite coatings consisting of an amorphous matrix with embedded nanostructured solid lubricant particles will be tested for the formation of coatings in the high-pressure cold spraying process, creating new solutions for the industry. The properties of cold sprayed amorphous coatings will be optimized based on the Taguchi experiment.

The obtained knowledge on explaining phenomena related to the new generation of high-pressure cold sprayed composite coatings with Fe-based amorphous matrix with the nanocrystalline solid lubricant particles, their formation description, characteristics of the microstructure, surface topography and their correlation with the mechanical and tribological properties will be significant and proven achievements in the discipline of materials engineering. Nowadays, there are no examinations of the microstructure and properties of amorphous composite coating. The ecological aspect is also significant and must be underline, as eliminating a liquid lubricant prevents environmental pollution.