Is an explosion rightly associated with destruction? Well, the industrial use of generating large amounts of energy in a short time contradicts these spontaneous associations. Explosive welding (EXW) is currently a frequently used industrial technique that enables the joining of materials that are impossible or difficult to join using conventional welding techniques. The process enables the production of multi-layer composites that are widely used in strategic industries, such as the chemical, energy, arms, as well as aviation and space industries. Thanks to the relatively large freedom in selecting the base materials for composites, scientists and technologists can design new, unique material features. The huge research potential and many possibilities offered by the explosive welding method are the *'spiritus movens'* of this project.

The project aims to develop a new generation layered material based on Al, Ti and Mg metal alloys, characterized by low density, good mechanical properties and, most importantly, the ability to shield an electromagnetic field. The electromagnetic field shielding effect is the phenomenon of surrounding space with an appropriate material to reduce the levels of electromagnetic fields on the side of the screen opposite to the location of the field source. One of the factors that increases the effectiveness of shielding is the number of interphase boundaries of the system. Therefore, one way to improve shielding efficiency is to use multilayer materials with layer thicknesses measured on the micrometre scale. The hybrid procedure of combining explosive welding with accumulative roll-bonding (ARB) and heat treatment seems to be an unrivalled technique for producing this type of material. On the one hand, it ensures excellent quality of the connection of the parent metals. On the other hand, it allows for the reduction of the thickness of the composite layers and the introduction to the system of a large number of new interphase boundaries.

To explain the influence of interphase boundaries between alternately arranged thin layers of light metal alloys Al, Ti, Mg and intermetallic phases produced by heat treatment, on the properties of the composite, including shielding effectiveness, a comprehensive research program was formulated. In the first step, composite boards were prepared using the EXW method. Then, to increase the number of interphase boundaries and thin out the individual layers of the composite, the plates were subjected to the ARB process to finally carry out heat treatment, initiating diffusion processes between the individual layers of the composite and creating intermetallic layers that strengthen the structure and the effectiveness of field shielding. To analyse the effects of the planned research steps, comprehensive tests were used, based on the evaluation of the state of the microstructure, phase composition, texture and mechanical properties of a multi-layer composite based on light metals. A thorough research plan will allow for the explanation of the relationship between the state of the microstructure near the junction of individual composite layers and the material properties on a macro scale.

The project has interdisciplinary features because it brings together issues at the intersection of materials engineering and the construction and operation of machines. The effects of the project will contribute to a better understanding of the interaction of thermodynamic, mechanical and microstructural phenomena during phase transformations. The project results are both scientific and practical. They inspire the development of issues related to composites based on light metals and provide a knowledge base covering techniques for producing innovative multilayer materials. Carrying out research in cooperation with an industrial partner and other research units creates an excellent space for integration and exchange of ideas. It will allow building a solid foundation for further cooperation by implementing the results and new ideas in national and international projects focusing on the design of multi-layer composites manufactured using explosive welding technology.