

The aim of this project is to recognize and describe the mechanisms of the transformations taking place during the adiabatic shear bands (ASB) formation during high speed deformation, as well as their effect on the failure process.

In the performed research, it was assumed that: (i) formation of ASB is essentially based on the same mechanisms as those observed during isothermal shear bands formation in processes realized at 'conventional' strain rates, (ii) the occurrence of recovery and recrystallization effects inside the structure of ASB is the secondary effect which results from the influence of the temperature on severely deformed areas of ASB, and (iii) by the methods based on *the grain boundary engineering* it is possible to increase the impact resistance of metals.

The research program that is proposed will be focussed on characterization of ASB in fcc and hcp, single- and poly- crystalline metals. *On the one hand* there will be performed the investigations of the influence of high (using Drop Hammer) and extremely high strain rates (using explosive charge) on the (micro)structure and texture evolutions as well as the description of mechanical properties changes accompanied the ASB formation during deformation in channel-die. *On the second hand*, there will be performed analyses of the damage process during ballistic loading. In that case the identification of the mechanisms responsible for the projectile penetration will be at the heart of interest. The issue will be combined with analysis of temperature and severe plastic deformation influence on the ASB formation and then the voids nucleation.

Despite the issues investigated in the project are inspired by the actual problems resulting from industrial practice the project is within the group of research works of basic character. However, obtained results can be helpful in the future for formulation of specific application recommendations. It concerns fundamental aspects of the microstructural transformations and new technologies of armoured materials producing. From the scientific point of view, the activities crucial for practical application of the project results are the identification of phenomena taking place in the strain localization zone and a demonstration of their connection with the impact resistance of the material. This description especially refers to the microstructural changes, the identification of phase transformations and generally, morphological changes due to ASB formation.

Since the studies are of fundamental nature they would help to identify and describe the mechanisms responsible for ASBs formation and their influence on voids formation and cracks propagation during impact loading. The latter are extremely interesting for the applications in the aircraft and the armaments industry. In the case of the latter, the materials modified by grain boundary engineering methods are especially suggested for potential industrial applications as materials exhibiting a high breakdown resistance. They can be used not only for the protection against ballistic operations but also the ones originating from other impact hazards, both to people and vehicles or buildings. This research will be a significant contribution to the research issues undertaken in Poland a few years ago, which were inspired by the industrial practice.