The aim of the project is to investigate the impact of severe plastic deformation (SPD) of materials procured by hydrostatic extrusion (HE) generating clear anisotropy in two mutually perpendicular directions (in accordance with the deformation axis and perpendicular to it) on the thermo-physical properties of selected materials

Global technological development has created increasing demand for new materials characterized by special mechanical, physical or chemical properties. This phenomenon determines intensive research in the field of new technologies such as methods of severe plastic deformation (SPD). One of the major research directions is increasing the strength of materials as a result of the fragmentation of the microstructure to the ultra-fine grain (UFG) or nanocrystalline (NC)

With the development of SPD methods also researched have been other properties of materials with finely refined microstructures, now drawing the attention of scientists. These include tests of corrosion, impact resistance, fatigue, heat stability, and electrical conductivity. There are no, however, fundamental research studies of thermo-physical properties such as thermal diffusivity and specific heat attempted at understanding of their changes in materials subjected to the SPD processes. Thermal diffusivity and specific heat are the basic thermo-physical parameters used in the temperature analysis of materials used in many areas of application.

Research of thermo-physical properties has been conducted very rarely, limited to classical SPD methods like ECAP, and has not taken into account the anisotropy of strongly defected and texturized materials. Recognition of the reasons for the changes in thermo-physical properties of materials resulting from severe plastic deformation and of the accompanying changes in their texture will answer the question of the mechanisms and processes responsible for these changes.

The proposed research is innovative and will provide more reliable data on the impact of severe deformation on thermo-physical properties of selected metals, i.e.: morphology, and the degree of defects and grain refinement.

The project will examine three different materials: 99.95% pure copper, a copper alloy of chromium and zirconium CuCrZr and austenitic stainless steel 316L. All the selected materials have the same A1 (FCC), crystallographic Network, similar density (8-9 g/cm3) and a melting point above 1000° . They also have similar specific heat at 20°C (0.4-0.5 J/gK). The copper and copper alloy are drastically different in terms of their thermal conductivity, more than 20-fold higher compared to 316L stainless steel. The presented choice of materials will enable the comparison of a single phase with a multiphase material (Cu and CuCrZr), as well as with those with distinctly different thermal conductivity (CuCrZr and 316L). The determination of the magnitude of the changes in thermo-physical properties and their correlation with the microstructure will enable informed control of these properties in modern engineering materials. This will help to properly select materials for specific applications, operating temperature range, their viability and other factors dependent on thermo-physical properties.