Magnesium-based alloys, owing to such properties as low density, high strength, and high corrosion resistance, are very attractive materials for many scientists and engineers engaged in designing new materials for various branches of industry and science. The ability of these alloys to interact with hydrogen provides them with a high potential as hydrogen storage materials.

The depletion of natural mineral resources used in the power and motor industry, as well as the greenhouse effect causing disadvantageous changes in the climate, have led in recent years to intensive research on new ecological high energy sources. One of such sources is hydrogen, which fulfils both the ecological requirements (hydrogen combustion does not emit greenhouse gases into the atmosphere) and the energetic ones (hydrogen energy density =143 MJ/kg). However, the use of hydrogen in fuel cells or combustion engines requires the elaboration of an economical method of hydrogen sourcing, as well as its storage in a safe manner, mainly due to its strong explosive properties. In regard to the storage techniques, hydrogen can be collected in containers in the form of liquid or compressed gas, adsorbed on the material's surface (different types of carbon materials), or chemically bonded in the form of hydrides. Storing hydrogen in its liquid or compressed form is hazardous as well as uneconomic due to the high costs of compression with a low volumetric capacity equalling about 40 kg/m^3 and the necessity of its storage in special cryogenic containers at the temperature of 20 K. Because storing hydrogen in its adsorbed form on the material's surface, as well as in the form of metal hydrides and intermetallic phases, is a safe process, metal hydrides, and carbon-based materials constitute two main types of materials which, for the last dozen or so years, have been the subject of research in respect of their application as hydrogen storage materials.

Hydrides based on magnesium alloys are one of the most promising materials used for hydrogen storage. The continuous interest in these alloys results from their many practical advantages, such as hydrogen's high gravimetric capacity (up to 7,6 % wt. for MgH_2) and a relatively low cost. Also, magnesium is non-toxic and commonly available. However, the necessity of applying high temperatures as well as the slow kinetics of hydrogen sorption excludes magnesium from its practical application for hydrogen storage. That is why, at present, research is being conducted globally aiming at improving the hydrogen sorption kinetics in magnesium alloys through their modification with alloy additions.

Alloys based on magnesium, apart from their ability of hydrogen storage, have also many other potential applications. In recent years, owing to their excellent biocompatibility and biodegradability, they have been intensively studied in respect of their use as biomaterials. Metals such as silver, titanium, or copper characterize in the ability to increase the antibacterial effect and biocompatibility of alloys as well as improve their mechanical properties. That is why, during the design of new materials, it is important to know their thermodynamic properties. **In the case of the proposed Cu-Mg-Ti and Ag-Mg-Ti systems, there is no information on their thermodynamic properties. And so, the main aim of the project will be to determine the thermodynamic and physico-chemical properties of alloys from the Cu-Mg-Ti and Ag-Mg-Ti systems.** The binary Cu-Mg and Ag-Mg alloys have already been studied, and they are known to exhibit affinity for hydrogen. That is why it is justifiable to subject the produced alloys from the examined ternary systems to investigations showing how they are able to react with hydrogen and what properties such materials characterize in. In order to realize the assumed goals, the following tasks are proposed:

- Obtaining alloys from the Cu-Mg-Ti and Ag-Mg-Ti systems and their morphological and structural characterization by means of the SEM/EDS and XRD methods.
- Calorimetric studies of the formation enthalpy of selected intermetallic phases from the examined systems.
- Calorimetric measurements of the mixing enthalpy of the liquid alloys Cu-Mg-Ti and Ag-Mg-Ti.
- Studies of the phase transformations occurring in the obtained alloys during their heating and cooling.
- Optimization of the thermodynamic properties of phases and calculation of the phase equilibria for the Cu-Mg-Ti and Ag-Mg-Ti systems by means of the ThermoCalc and/or Pandat software.
- Examination of the ability to react with hydrogen of selected alloys from the Cu-Mg-Ti and Ag-Mg-Ti systems.
- Examination of the properties of the selected alloys' products of reaction with hydrogen.