## *Description for the general public:*

The uncontrolled development of industry and the rapid progress of civilization is a serious threat to the environmental. Hence, nowadays a very important issue is the environment protection. One of its aspects is the utilization of the constantly increasing amount of waste. Depositing them at landfills has a negative impact on the environment, which is why the thermal utilization of waste is becoming more and more popular. For example, there are seven municipal waste incineration plants in Poland with a total processing capacity of around 1 million tonnes per year, and plans to build more. In addition to reducing the weight and volume of incinerated garbage, an important advantage of this approach is the possibility of recovery of electricity and heat.

Thermal waste treatment generates, however, a certain amount of unburned residues, i.e. fly and bottom ashes. What's more, these ashes often contain toxic substances, including heavy metals, posing a threat to the environment and, consequently, to human and animal health. Therefore, the aim of the proposed project is to develop a material that could be a matrix for disposal of bottom ash from waste incineration containing heavy metal ions.

A popular method of immobilizing heavy metals is solidification and stabilization of waste with Portland cement. However, in the face of the latest research, cement is presented as an unstable material in such application, which is mainly related to the negative effect of some ions on its structure. Therefore, other materials are sought for – due to the high chemical durability the appropriate matrix appears to be the structure of alkali activated binders – the so-called geopolymers. Immobilization capacities of both mentioned matrices are mainly related to the properties of hydrated calcium and sodium silicates, i.e. hydration products. Thus the second, equivalent objective of the proposed project is a comprehensive analysis of the structural properties of the materials obtained. Among many research methods used to describe the structure of alkali-activated composites, vibrational spectroscopy occupies one of the main places. An attempt will be made to demonstrate that a description of the structure of obtained materials on a basis of vibrational spectra, and consequently the use of the proposed methods for controlling the process of their preparation as well as quality control is possible.