

Research of the Non-Explosive Expansion Material in an underground mine extracting hard coal in the environment of existing natural hazards

Abstract

This dissertation presents a comprehensive research of the Non-Explosive Expansion Material (NEEM). The aim of the examination was to prove the usefulness of the Non-Explosive Expansion Material in mining works in an underground mine extracting hard coal in the environment of existing natural hazards.

Non-Explosive Expansion Material are dry powdered substances occurring at room temperature in the form of white, fine crystalline solids. Due to their hygroscopic properties, they react with water in the process of hydration, that is, transformation of anhydrous minerals into hydrated minerals. This process is accompanied by the release of significant amounts of heat and the substance in the new structure increases its volume. In a closed space, this results in a pressure of 30–40 MPa.



The complex of studies included natural hazards appearing in the mines, such as:

- methane hazard and the impact of the Non-Explosive Expansion Material on the methane and air mixture inflammation,
- the presence of dangerous coal dust and the possibility of coal dust cloud ignition,
- the impact of the Non-Explosive Expansion Material on the process of coal self-heating and endogenous fire.

There were also additional tests to identify gases produced in the process of hydration and to examine the chemical composition of the Non-Explosive Expansion Material to exclude the introduction of harmful or poisonous elements into the mine environment.

Another research was carried out to determine the maximum temperature during the hydration reaction and the force generated by the Non-Explosive Expansion Material.

Finally, in situ tests were conducted in the coal seam to determine the effectiveness of the Non-Explosive Expansion Material in the type of sedimentary rocks in the underground mine.

All the studies carried out proved the usefulness and safety of using the Non-Explosive Expansion Material in an underground hard coal mine in the environment of natural hazards. Instructions for safe use of the Non-Explosive Expansion Material in the underground hard coal mine have been developed.