

Influence of extreme temperatures on the performance properties of explosives

Abstract

The dissertation presents a method for assessing the influence of extreme temperatures on the explosives. The developed method of the assessment is based on the results of research carried out on market-available explosives used in Polish mining.

The research problem has been chosen for the dissertation due to need for complex assessment of the influence of extreme temperatures on the safety and performance parameters of explosives, particularly to determine the changes of sensitivity to friction and impact, VOD and ability to performing work. The limitations concerning this scope of research arise primarily from specific Polish mining and geological conditions and the value of the geothermal degree. Exposure of explosives to temperatures outside the range predicted by the manufacturer, is undoubtedly the circumstances conducive to carry on works, that allows to determine the influence of ambient temperature on the explosive parameters.

Therefore, developing the research method, whose development is the goal of this dissertation, is a vital element required to meet these demands and open the way for the advancement of research in this field.

The research realisation method proposed in the dissertation is directed at assessing changes of parameters of explosives. To meet the goals, research methods have first been chosen based on a literature review and then subjected to aggregation, which resulted in the formation of complementary solution.

Acting in accordance with the proposed procedure, explosives were exposed to extreme temperature. The time of exposure to extreme temperature was determined as the time, when the sample of explosive reached the approximate ($\pm 1^\circ\text{C}$) the ambient temperature.

Next, safety parameters (sensitivity to friction and impact) were determined at specified intervals. Followed by an observation, as a result of the analysis, the fulfilment of the safety requirements by the explosives, the determination of the VOD and the ability for performing work was carried out.

Adapting the research methodology specified in Directive 2014/28/EU and the group of standards EN 13631, the changes in explosives parameters were assessed at two extreme temperatures (low and high), using the time of exposure of these temperatures as a variable parameter. The results of the experiments have shown that the exposure of explosive to extreme temperatures has an influence on the VOD. Thus, the thesis of work has been proved.

A derivative of the conducted analyses was the statement that due to the inadequacy of methods described in group of standards EN 13631 and the difficulty in assessing the influence of extreme temperatures on explosive, it is necessary to construct assessment principles and methodology.

Based on the author's experience acquired during the author's participation in the works of the Accredited Explosives Materials and Electric Detonators Laboratory, which is a part of the Notified Body No. 1453 of the Central Mining Institute, a comprehensive procedure was proposed during the conduct of the evaluation.