Abstract

The presented dissertation demonstrates an identification method for the antistatic processing realisation techniques of plastics employed in underground bituminous coal mining, developed by the author.

Polish legislation obligates the manufacturers of products employed in Polish underground bituminous coal mining to ensure the products' antistatic qualities. An antistatic product, as it is assumed, does not pose the risk of igniting explosive atmospheres.

The aim of the dissertation is to isolate and characterise the antistatic processing techniques of plastics, and afterwards, based on the analysis of the current state of knowledge, to propose a self-developed identification method for the antistatic processing realisation techniques of plastics intended for use in potentially explosive atmospheres.

Antistatic processing, understood as imparting antistatic qualities to non-antistatic materials, is a complicated process with a wide selection of available methods of realisation. Conducting a single electrical parameter test allows only for the classification of a material as antistatic (conductive or dissipative) or non-antistatic (non-conductor). It does not identify the antistatic processing technique used for the material.

To assess the electrostatic qualities of a material, the selection of test methods available thus far have been divided in this dissertation into static parameter and dynamic parameter test methods.

Presented in this way, the aims of this dissertation, as well as the scope of work specified for them, have served to prove the thesis ascertaining that the methods used to assess the electrical qualities of products subjected to antistatic processing, based on the analysis of electrical parameter correlations (interdependence and interrelation), allow to establish an unequivocal identification and effectiveness assessment of the antistatic processing procedures.

As revealed by a literature review, no complex identification of antistatic processing realisation techniques of materials that would allow for their assessment has been established to this day. One can only find a division of antistatic procedures into internal and external.

In terms of subjects used in the research conducted according to the specified scope of work, the chosen materials were composed of plastics commonly employed in Polish bituminous coal mining. The research was primarily conducted using standard methods, which guarantee its repeatability and reproducibility, and eliminate any errors during repeated measurements, e.g. during the stability evaluation of studied electrostatic parameters.

The study of products manufactured for mining purposes carried out for this dissertation was supported by the study of a self-developed and self-conducted antistatic

processing procedure of plastics. The basic material in this procedure was modified using antistatic processing techniques identified in this work.

Complex research of the materials' static and dynamic parameters was thus carried out, as well as a presentation of their correlations, understood as their concurrence.

A part of this dissertation has been devoted to assessing the effectiveness of the identified antistatic processing realisation techniques – especially their stability. Effectiveness is understood here as an evaluation of the final product. It has been proven that a number of the antistatic processing techniques identified by the author are characterised by a large degree of heterogeneity of the final product, instability in time or an influence on the environment via exudation or flaking of the material subjected to antistatic processing, which may result in an electrostatic hazard under explosive conditions. It has been observed that the materials subjected to certain antistatic processing techniques are dependent on mine factors such as high relative height or mine water and lose their antistatic qualities, which may also result in an electrostatic hazard under explosive conditions. Unstable antistatic parameters of a product result in accident risk and carry with them consequences related to not meeting the requirements of Polish legislation.

The dynamic proliferation of plastics in products manufactured for use in industry consequently increases the amount of plastics employed in mining, which also served to provide material for the presented dissertation.

The conclusions of this dissertation may be of use to the manufacturers of plastics employed in Polish bituminous coal mining. As according to legislation, the manufacturers should, even if through higher expenditure, manufacture products that pose no danger of explosion during their entire working life.