Abstract

The Ph.D. thesis deals with the issue of stationary coal analyzers for discrete measurement of ash content with the use of natural radioactivity of coal. Such measurements support chemical methods, because they allow monitoring the coal quality in a short time (a few minutes). Thanks to this feature the coal parameters are determined almost immediately. Those kinds of analyzers are usually applied in the mining industry and power engineering.

The devices designed to carry out such tasks have to be adapted to work in difficult conditions. Their working environment are places where coal samples are collected and prepared for laboratory analyses, as well as containers located close to a heaps of coal. In addition, it is required that the time of the sample measurement should be as short as possible. Moreover, the weight of the sample should not exceed a few kilograms so that its transport from the collection point to the analyzer should not be too much burden for the quality control personnel.

Strict requirements with respect to such analyzers, and with respect to the properties of the measured material, make it necessary, in relation to the specifics of the applied measurement method, to look for compromise solutions that would guarantee the measurement uncertainty on a required level.

The work identifies the factors which can impact the measurement uncertainty with respect to ash content in coal and provides reasonable solutions to mitigate negative effects and improve quality of results.

The following issues concerning measurement method were discussed:

- selection of a proper energy range of the gamma-ray spectrum of the measured sample used for ash content assessment based on statistical analysis of wide range of data concerning ash and radioactivity content in different samples of coal,
- impact of water (total moisture) that is contained in coal on the measurement of the natural radioactivity of coal in order to determine the content of ash in the sample,
- measurement of coal samples of different grain-size categories,

as well as the improvement of technical solutions applied in the tested equipment:

- selection of optimal scintillation detectors,
- selection of proper measurement geometry,
- assessment of the impact of background radiation on the measurement result of natural coal radioactivity,

The research results can be helpful in designing new devices based on the measurement of natural gamma radioactivity of the analyzed material and already are applied in the new version of GAMMA NATURA 2.