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Interdisciplinary topics in Mining, Geology and Geomatics

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Measurement with PEMS gas analyzer in real underground mine conditions

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Abstract

Currently, the extraction of minerals in underground mines is becoming increasingly difficult. There are many natural hazards in underground mines. One of the most dangerous is the **gas hazard**. To ensure safe working conditions for personnel in the face of gas hazards, it is necessary to constantly monitor environmental parameters and analyze the concentrations of harmful gases. One of the most harmful gases is **nitrogen oxides (NOx)**, whose presence in an underground mine is mainly related to the technological process. The article presents measurements of nitrogen oxide and nitrogen dioxide concentrations using a reference method - the **AVL Gas PEMS gas analyzer**, using the **NDUV measurement method**. The research was carried out in one of the Polish ore mines. The results were analyzed in the context of the mine's technological cycle.

Mining area for experiment

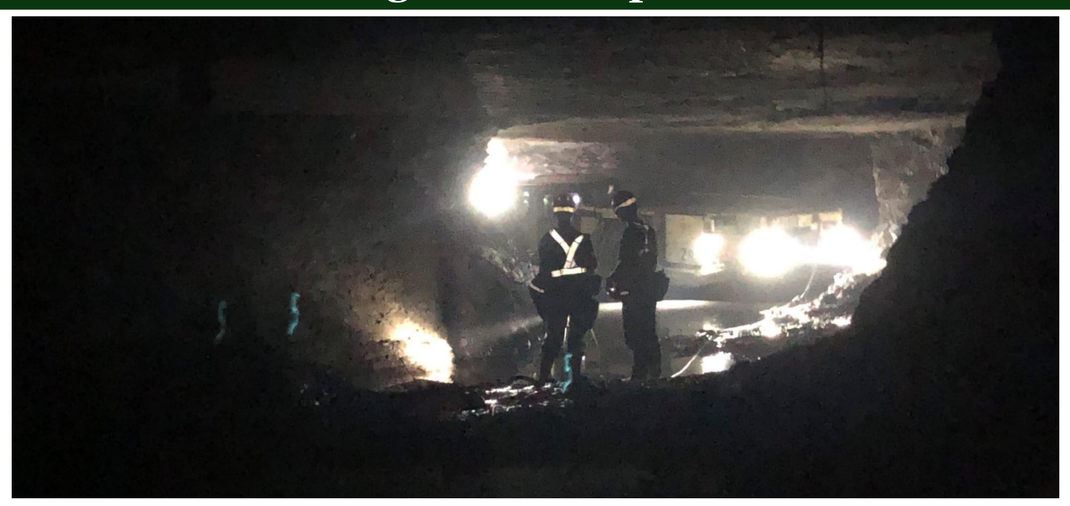

Figure 1. Excavation of an underground mine

State of the art

One of the most important and dangerous is the gas hazard. The most harmful to the living organism are gases such as carbon monoxide (CO), hydrogen sulfide (H_2S) and nitrogen oxides (NOx) [1]. In Polish copper ore mines, the risk of NOx is very high. The majority of NOx comes from technological processes, and the main source of pollution is primarily machinery, all of which is powered by diesel engines. In addition, nitrogen oxides in the mine come from process blasting and welding work [2]. A natural source of the origin of nitrogen oxides is the oxidation processes of nitrogen in the mine atmosphere or the naturaloutflow of these gases from the rock mass [3].

Measurement

The air intake pipe for the analyser was suspended from a safety grate onthe vehicle. The inlet to the pipe was aligned with the direction of travel to reduce the proportionof exhaust gases from the exhaust system.

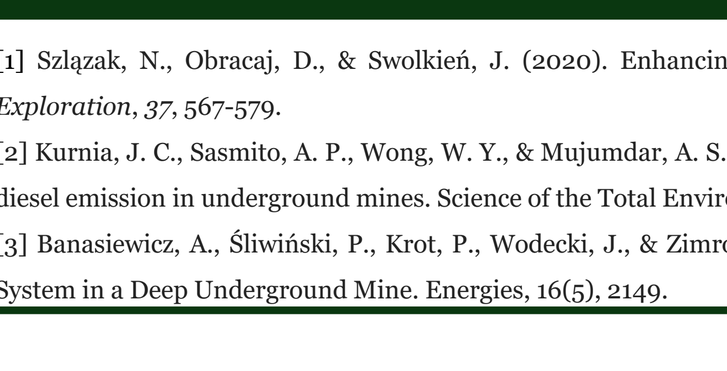

Figure 2. Measurements with a PEMS analyzer

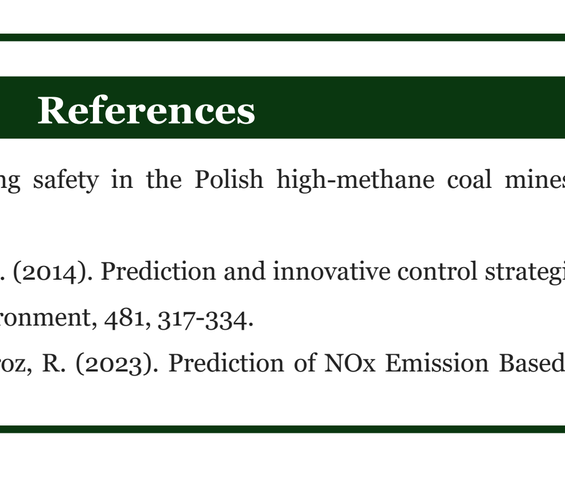

Figure 3. PEMS gas analyzer in an underground mine

Figure 4. Results of PEMS gas analyzer measurement in an underground ore mine

Conclusions

1. The performance of the AVL Gas PEMS gas analyzer was demonstrated in real underground mine conditions.
2. There is an increase in nitrogen oxide concentrations where the measuring station was near the passing cart and where there is a higher concentration of exhaust gas, i.e. at the mining face. After the entry of the vehicle with the analyzer into the excavation ventilated by the fresh air, one can see a significant decrease in NO concentrations and a slight decrease in NO2 concentrations.

References

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