Summaries

MARIAN BRANNY

Numerical Simulation of Ventilation in Blind Headins ● Kwartalnik Górnictwo i Geoinżynieria ● z. 1, 2005

The study explores the potential of numerical modelling of airflow in blind headings. The main focus is forecasting the ventilation parameters in headings and galleries characteristic of copper mines belonging to the LGOM Corporation. The fundamentals of mathematical modelling of turbulent flows are provided. The model makes use of 3D continuity and Rynolds equations, the equation of turbulent transport of chemical components and the equations of the k-ε model (kinetic energy of turbulence, the rate of kinetic energy dissipation). The discretisation procedure involved the control volume method and the technique UPWIND. The developed numerical codes employ the hybrid schemes and power-law techniques. Nonlinear systems of discrete equations were solved with the use of SIMPLER procedures. 3D velocity fields and gas concentrations calculated for galleries are provided. The chief objective is to eliminate the hazardous conditions caused by the presence of gas pollutants emitted by diesel-powered engines in machines and produced in the course of blasting operations. The results of numerical solutions of steady-state velocity field and the time-space field of concentration of gaseous pollutant emitted by lumped or distributed gas sources are presented. The accuracy of numerical representation is evaluated by comparing the prognosticated values with measurements. The obtained physical fields by way of numerical procedures portray the real fields sufficiently well for practical purposes.

Keywords: underground ventilation, auxiliary ventilation, numerical simulation of airflow

KRZYSZTOF FILEK, WALDEMAR FRANCZUK, PIOTR ŁUSKA, BERNARD NOWAK, JANUSZ ROSZKOWSKI

Air Cooling by a Small-sized Water Longwall Air Coolers ● Kwartalnik Górnictwo i Geoinżynieria ● z. 1, 2005

The results of measurements of cooling water temperature and temperature and humidity of cooled air, which were taken in longwall no. 3 of seam no. 502 at part J in "Śląsk" Colliery during the operation of a unit consisting of 4 small-sized diaphragm water air coolers (these are the first units of this kind in Poland) are presented in this paper. The measurement results of heat power for each air-cooler, temperature and specific humidity of cooled air were compared to calculation results, which were obtained on the basis of the equations presented in the paper. The research was conducted for two variants of air-coolers' connection to a water pipe – in series (variant A) and in series – parallel (variant B). The results of calculations and measurements are presented in the tables and the graphs. The conducted research allows to determine that total heat power of four air-coolers is within limits 120÷130 kW. The greater power of the system with a series-parallel coolers' connection can be observed in the form of a slightly lower air temperature in the longwall; behind the outlet of the longwall air temperature was reduced by 2.2°C (variant A) and 2.8°C (variant B) in comparison with the situation without cooling.

Keywords: air cooling, mine air conditioning, diaphragm air-cooler

KRZYSZTOF FILEK, WŁADYSŁAW MIKOŁAJCZYK

Heat Exchange between Air and Cooled Water in a Pipeline Located in a Dead-end Heading ● Kwartalnik Górnictwo i Geoinżynieria ● z. 1, 2005

If we want to use a water diaphragm cooler of air in a dead-end heading, cold water must be brought into it through a pipeline. Heat capacity of such a cooler depends on the temperature of water supplied to it. Locating

a water pipeline in a heading, in which warm air flows, leads to an increase in the temperature of water in pipe and is higher at the inlet of a cooler than at the inlet of pipeline. This article presents equations of air enthalpy balance in the dead end heading (without water vapor condensation on the external surface of the pipe) and cold water flowing through an insulated pipeline to the cooler of air as well as equations describing heat flow through the side wall of a pipeline from air to water. A set of equations of air and water enthalpy was solved analytically, giving distributions of air and water temperatures along the heading and, later on, using the dependences describing heat transmission through the wall of a pipe. Both distributions of temperatures of internal and external sides of pipe in the heading and the distribution of elementary heat flow exchanged between air and water are given. A calculation example, whose solution – distributions of the values mentioned above along the heading are shown in the form of graphs, was presented. An increase in temperature of cold water in a pipeline was also presented.

Keywords: heat exchange, mine pipelines, air cooling

NIKODEM SZLĄZAK, JUSTYNA SZLĄZAK

Possibilities of Nitrogen Oxide Reduction from Coal Machines Fumes • Kwartalnik Górnictwo i Geoinżynieria • z. 1, 2005

This article presents the method of Selective Catalytic Reduction as an example of usage in nitrogen oxides decomposition to molecular nitrogen and oxygen. The review is mainly focused on the description of the catalytic properties of CoZSM-5 in selective catalytic reduction (CH_4-SCR) of nitrogen oxides. Due to EPR and UV-VIS researches speciation of cobalt ion in ZSM-5 matrix was described and TOF analyses helped to characterize the most active catalytic center. Furthermore, the mechanism of the NO_x reduction and the formation of Co dinitrosyl complexes, as an important intermediate in SCR reaction, was presented.

Key words: coal mine's atmosphere pollution, nitrogen oxides decomposition, catalyst