UDK 622.8

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TECHNOLOGIES TO IMPROVE THE QUALITY CMM GAS RECOVERY TECHNOLOGY OF MINE

Existing technologies for mine gas recovery ensures optimum efficiency energy recovery and ensures removal of a substantial percentage of methane emissions due to coal mining. Best practices and standards in the collection and drainage of mine methane gas will ensure the concentration and stable flow which will allow its use in various applications at very low cost. At this time there is available a wide range of potential applications from use as fuel in furnaces, boilers or ovens use as fuel for internal combustion engines, turbines or microturbines, to produce energy, liquefied gas production, field first chemical fertilizer industry, natural gas substitute.

Key-words: mine, gas recovery, alternative energy, gas transformation

1. TECHNOLOGIES FOR REMOVAL OF NITROGEN (N_2).

From a technical standpoint elimination/reduction of nitrogen from mine gas

(CMM), raises the greatest difficulties, available technologies while being the most expensive. In terms of availability for industrial applications at this time can be nominated five technologies, namely:

cryogenics;

nitrogen absorption technologies based on variations in pressure (pressure swing absorption PSA);

solvent absorption technologies;

technologies of molecular absorption filters (molecular gates technology NRU);

membrane technology absorption.

Cryogenics - using a series of heat exchangers to liquefy the gas flow at high pressure mine and a splitter distillation nitrogen is excreted as current high nitrogen content gas. The system provides the highest methane recovery and is the most economical in terms of investment while the processing capacity exceeds 5600 Nm3/hour.

Nitrogen absorbtion technologies based on variations in pressure (pressure swing absorbtion) - is based on gas absorption property at a given pressure by solid surfaces, absorption capacity is much greater as the gas pressure is higher. The technology is based on different affinity to various gas absorption sound absorption area. If CMM nitrogen removal is accomplished by passing the gas stream at high pressure through a solid bed room absorption affinity for nitrogen, exhaust gas stream is enriched in methane. After saturating the absorbent bed by reducing the absorbed nitrogen is released from the absorbent bed facility and is ready for a new cycle. In general, porous materials are used to create a large contact surface as the flow of CMM, the most commonly used bedding material is activated of carbon, zeolites, alumina, silica gels.

Solvent absorption technology - is based on selective absorption capacity of specific solvents for various gases. Generally resort to solvents commonly used in petro-chemical solvents released sparing methane-rich gas stream nitrogen in a low temperature environment.

Molecular absorption filter technology - based on molecular filters which have the property of accurately adjusting the pore size of 0.1 Angstrom. For CMM pore size is controlled in molecular size larger than the size of methane and molecular nitrogen, oxygen, carbon dioxide and water.

This will allow the pores to absorb nitrogen, carbon dioxide and other constituents except bed methane absorber passes over the same pressure as the input. To remove contaminants reduce supply pressure, thus allowing desorption of contaminants from absorbing filter.

Membrane absorbtion technology - is based on using membranes that allow selective passage of methane, ethane or other hydrocarbons, but are impermeable to nitrogen. For the nitrogen content of 6-8% process is based on single-stage filter for higher concentrations will consist of two stages process with membrane filtration.

2. TECHNOLOGIES FOR REMOVING OXYGEN O_2, CARBON DIOXIDE CO_2 AND WATER VAPOR.

Disposal systems oxygen, carbon dioxide and water can function as separate units but are usually integrated in complex systems which eliminate all four contaminants, interconnected processes on the same location. Available technologies for removing other constituents of the gas are presented below.

Removing oxygen from mine gas is considered as the second most important component of technologically and economically CMM purification process. This process is extremely important because of limitations imposed quality standards for gas transmission pipeline networks typically less than 0.1% oxygen concentrations. When using PSA technology (pressure swing absorbtion) and molecular gates NRU technology have shown that nitrogen removal is achieved by removing the oxygen so that oxygen deficiency in bottom proportion is very easy final, but when using cryogenic technology or organic solvents to remove oxygen system must occupy the first position in the purification process due to substantial increase in the risk of explosion high purification process.

To remove carbon dioxide are available technologies which including absorbent membrane, selective absorption, or units containing organic compounds ammonia derivatives. Amine units are tolerant only at very low oxygen content and therefore disposal unit of carbon dioxide must be located in flux after oxygen removal unit.

Removing water vapor from CMM is the simplest component of the gas purification mine and often is fully a molecular filter dewatering preferred over other solutions because of lower operating costs.*CMM conversion into synthetic fuels*

Technological transformation of liquid gas became available since the 1920 s, but large initial investment costs related to the construction of facilities for processing natural gas in synthetic fuels have been the main obstacle to their widespread, especially given that demand for fuel Petroleum products demand was much higher. Conversion technology in liquid methane best results is Fischer - Tropsch synthesis technology, based on a series of chemical reactions leading to a series of hydrocarbons, of which the most important are the saturated hydrocarbons (alkanes):

$$(2n+1)\ H_2 + n\ CO \rightarrow C_nH_{(2n+2)} + n\ H_2O$$

Gaseous compounds necessary to obtain the Fischer-Tropsch reaction, first be desulfurized gas to protect the catalyst, followed by a set of reactions that improves the H2/CO ratio. Of these two reactions are most important, namely:

reaction of transformation of water into gaseous compounds

$$H_2O + CO \rightarrow H_2 + CO_2$$

reaction converting methane into carbon monoxide and hydrogen

$$H_2O + CH_4 \rightarrow CO + 3\ H_2$$

Discoveries of the last decade about the necessary catalysts in Fischer-Tropsch technology have led to a significant reduction in production costs so that synthetic fuel production plant with a capacity of less than 5,000 barrels/day is perfectly feasible. The technology is also applicable while the methane concentration is less than 40% and nitrogen concentration above 30%.

Uing the CMM to produce substitutes Liquified Natural Gas (LNG, Liquefied natural gas)

Use mine gas to produce liquefied natural gas a replacement is an attractive option for mining operators because:

technological progress achieved for small refrigeration facilities suitable for the LNG conversion CMM, has led to the installation characterized by low specific costs, especially in areas without access to pipeline transport networks of the final product;

all available technologies can operate mine gas derived from prior degassing activity (with high methane gas) and gas mine degassing activity coming from areas operated or closed amines (average content of methane gas);

in all cases, mine gas is used at a pressure close to atmospheric pressure, reducing gas compression costs;

can use gas mine the concentration of nitrogen amounts to up to 30%.

do not assume the existence of pipeline networks and can be transported by car or rail;

existence of a local or regional markets for LNG leads to a substantial reduction in transport costs.

CONCLUSIONS

The decision to implement a project of mine gas recovery is finally captured economic decision but this decision requires careful consideration of all the variables and constraints of technical, technological, commercial, legal and / or institutional intervention. Finally this decision may have effects that at first sight are not obvious but that could materially affect the main business of mine operator or underground exploitation of coal.

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Рукопись поступила в редакцию 18.04.13

UDK 622.235.2

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MODERN DEVICES FOR DATA AND CONTROL AQUISITION USED IN THE MONITORING SYSTEMS CONSTRUCTION AND DESIGN FROM UNDERGROUND FACILITIES PRONE TO EXPLOSIVES AND TOXICITY

This paper presents a cluster consisting of a control and transmission system that monitors and reports gas leaks in the surrounding environment or atmosphere. The first part of the paper presents the architecture and the structure of the monitoring system, as well as the logical part of the system which consists of the software designated to system operation. The final part of the paper is the actual implementation of the system, consists of a demonstration using the software in real time by monitoring the environment that has explosive potential.

Key-words: Gas leaks, AdamView, voltage, serial transmission, sensors, methane, pollutant emissions.

1. INTRODUCTION

The ceaseless control of the security parameters is done by the use of local and portable detectors, of automatic installations and devices for continuous or intermittent measurements. These devices have alarms and a function that, if needed, stops the energy when the preset concentration rises.

In order to do a constantly and continuous monitoring, every active or inactive working place has got measuring devices(detection tips). These consist of transmitters for gas detection (methane, carbon monoxide, carbon bioxide), detection of air speed, temperature, etc. and an encoder to code and transmit the information to the active monitoring systems. The nowadays parameter measuring system gives us a sign of danger when reaching a certain alarm threshold and it shuts down the power supply and the entire activity, without a prior intimation about risk and possibility of a fast intervention to prevent a dangerous situation.

Its flexibility allows the system to be successfully implemented in vast areas such as chemical industry, extractive and oil industries, where it is very important to strictly control the concentration of gas in the atmosphere so as to prevent the risk of explosion. The system transmits data (concentration) of monitored gases at a reception system called "Controller". Controllers are data acquisition systems, signal receivers and monitoring that accept input signals (mA, mV) of gas detectors (transmitters), they are designed for all types of industrial applications and on-line or in-line processes. Available outputs are: relays, analog signals, digital protocol communication lines with integration in complex automatic systems.

2. THEORETICAL FACTS REGARDING THE CONTINUOUS MONITORING SYSTEM

This system consists of a maximum of sixteen measuring channels which gather information from up to a maximum of sixteen sensors placed in danger areas. The analogical signal sent by these sensors is turned into digital signal by an Advantech Adam 4017 conversion unit and transmitted to the operating unit which displays the percentage and also diagrams of the concentration.

After receiving the data from the sensors, the operating unit processes the data and sends commands such as visual and acoustic alarms, shutting down the power, etc.

The data receiving channels work on 4-20 mA, voltage 0 – 10 V, 0 – 1 V. The executive unit relays take 250 volts AC, 30 volts DC and 5 amps. When using the continuous monitoring system for monitoring methane, the pre-alarm and alarm thresholds are set to 1% and 2% volumetric fractions methane (CH_4).

3. BASIC ARCHITECTURE DESIGN OF THE MONITORING SYSTEM

The monitoring and alarm system for toxic and explosive gases needs high security and consists