APPLICATION OF HIGH VOLTAGE ELECTRIC DISCRETE METHOD IN MINING ROCK CRUSHING

Zairov Sh.Sh.[1], Arziyeva S.I.[2]

[1]Zairov Sherzod Sharipovich – Doctor of Technical Sciences, Professor,
DEPARTMENT OF MINING;
[2]Arzieva Suraye Ismatullaevna – Assistant,
DEPARTMENT OF HIGHER MATHEMATICS AND INFORMATION TECHNOLOGIES,
NAVOI STATE MINING INSTITUTE,
NAVOI, REPUBLIC OF UZBEKISTAN

Abstract: *the article analyzes Improving the efficiency of crushing and production of rocks with the help of products made from local raw materials, which are important for the development of the economy of our country are topical issues today. This thesis considers measures for the application of physical processes in mining. As a result of this method, 20% economic efficiency is achieved.*
Keywords: *analysis, Current, voltage, current density, electric arc, discharge, electron, ion, pressure, temperature, rock, Kyzylkum region, drilling.*

ПРИМЕНЕНИЕ ВЫСОКОВОЛЬТНОГО ЭЛЕКТРИЧЕСКОГО ДИСКРЕТНОГО МЕТОДА ПРИ ДРОБЛЕНИИ ГОРНЫХ ПОРОД

Заиров Ш.Ш.[1], Арзиева С.И.[2]

[1]Заиров Шерзод Шарипович - доктор технических наук, профессор,
кафедра горного дела;
[2]Арзиева Сурайе Исматуллаевна - ассистент,
кафедра высшей математики и информационных технологий,
Навоийский государственный горный институт,
г. Навои, Республика Узбкистан

Аннотация: *в статье анализируются, повышение эффективности дробления и производства горных пород с помощью продукции из местного сырья, важного для развития экономики нашей страны, сегодня является актуальной проблемой. В данной диссертации предпринимаются меры по внедрению физических процессов в горноодобывающей промышленности, в результате чего достигается 20% экономическая эффективность.*
Ключевые слова: *ток, напряжение, плотность тока, электрическая дуга, разряд, электрон, ион, давление, темпратура, порода, Кызылкумский район, бурение.*

UDC 331.225.3

In the works of scientists who have made a significant contribution to the theory and practice of blasting in the opencast quarries of the Republic of Uzbekistan, developed scientific and technical bases for blasting rocks of different hardness, improved technological processes of drilling and blasting. High efficiency of blasting technologies is ensured in open pit mining in the region [1].

Despite the large volume of research in the Kyzylkum region, no measures have been taken to apply physical processes in mining, and no high voltage electric discharge method has been developed to increase the efficiency of drilling boreholes and wells in rock breaking. Drilling and blasting with a high voltage discharge method provides a 20% cost effectiveness. Today, this method is in high demand in manufacturing enterprises and is preferred for its simplicity and low cost compared to analogues.

As a result of research and analysis of the literature [2], it was found that a large amount of heat is released at the junction of two metal (or coal) rods in contact with each other, because the resistance of this place is large. The main technical results of the proposed method are the simultaneous determination of the values of specific energy consumption required for the separation of the unit lenght of the inter electrode space in the decomposition of rocks with the help of high voltage pulsed discharge and additional mechanical action on it with hard alloy cutters. It is to increase the efficiency of drilling with multi electrode drills by determining the phase of movement of drilling electrodes between two high voltage pulses, as well as the depth of rock breaking in one turn.

The temperature rises to the point where thermoelectric emission begins. Therefore, when the electrodes are separated, a discharge begins between them. Between the rods is formed a column of gas, which gives a strong light, and this column is called an electric arc. In this case, the electrical conductivity of the gas is much higher even at atmospheric pressure, because the negative electrode emits a lot of electrons (Figure 1). In a smaller arc, the current reaches several hundred amperes when the potential difference is only about 50V. The first electric arc was invented in 1802 by the Russian academician created by V.V. Petrov.

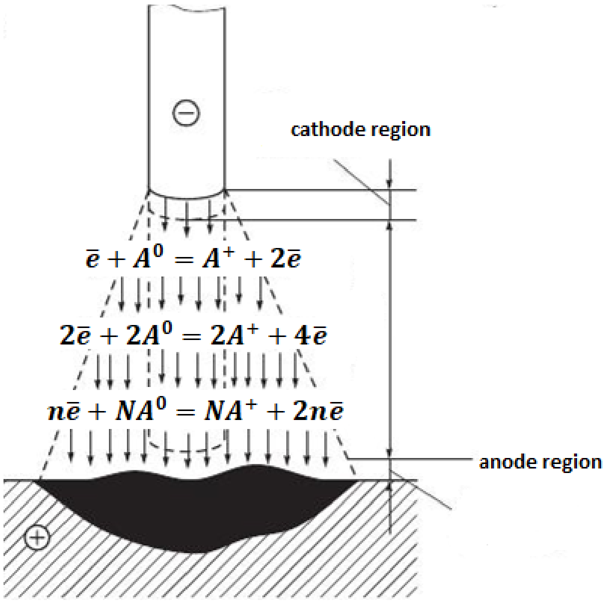

Fig. 1. Formation of an electric arc

Here the current density is equal to the sum of the current densities of the electrons and ions: j$= env$, $e = 1{,}6 \cdot 10^{-19}\,K$, $n = \frac{N}{V}$ (the number of electrons per unit volume). $j = j_e + j_i = en_e v_e + en_i v_i$. From this the current will be equal to $I_{yoyi} = en_e v_e S + en_i v_i S$. The total voltage is as follows [2]:

$$U_{yoyi} = U_{katod} + U_{anod} + U_{or},$$

$$U_{yoyi} = a + nl.$$

The high temperature at the cathode is supported by positive ions that bombard the cathode when the arc burns. The gas in the arc itself heats up as a result of a collision with electrons and positive ions accelerated by the field. As a result, the gas is thermally ionized. At the positive electrode of the arc, under the influence of electrons, a pit called a crater is formed. The temperature in the crater reaches $4000^0 C$ degrees at atmospheric pressure, and exceeds $7000^0 C$ degrees at $2 \cdot 10^6\,Pa$ pressure. To imagine how high this temperature is, let`s make a comparison: The surface temperature of the sun is about $6000^0 C$.

The electric arc burns not only between the carbon electrodes, but also between the metal electrodes. If the current is increased in a vibrating discharge, the temperature of the cathode increases so much due to the bombardment of the ions that the arc discharge begins. Thus, it is not necessary to bring the electrodes closer together in order for an arc discharge to occur. The electric arc is a very powerful light source that is used in projectors, projection devices and film cameras. Electric arc furnaces are widely used in metallurgy. Arc discharge is also used for welding metals.

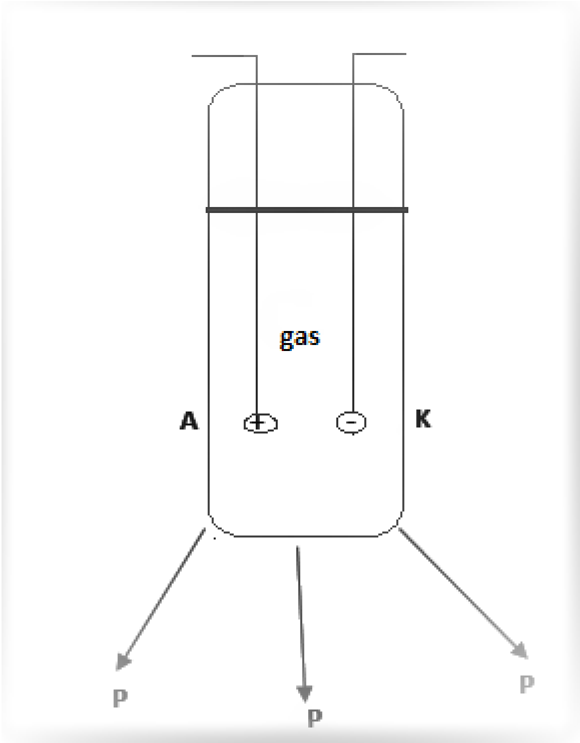

Fig. 2. Generation of an electric arc in the environment

Voltages of 220 and 380V are used for this process. The negative cathode and the positive anode are lowered into the well (figure 2) and a gaseous medium is formed there. The distance l between the electrodes depends on the composition of the selected rocks. $I = \frac{U}{R}$ that $R = \rho \frac{l}{S}$, S is the cross sectional area of the electrode in the range from $1{,}5\ mm^2$ to 2, $5\ mm^2$. The high pressure created by the electric arc drills the rocks.

References / Список литературы

1. *Ravshanova M.H.* Development of a new non-explosive crushing mixture for use in open pit mining // Doctor of philosophy in technical sciences (PhD) diss. Navoi, 2021. P. 13.
2. *Bendrikov G.A., Buxovsov B.B.* Physics. Tashkent, 2012. P. 262