ROCK CUTTING BY ELECTRIC PULSE METHOD

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The work is devoted to the development of an electric pulse method for cutting rocks and other solid dielectric and semiconducting materials. Previously, we have shown the possibility of electric pulse cutting with a two-electrode moving system with a low energy of the pulse generator, which will make it possible to create a competitive electric cutter in comparison with mechanical and plasma [1].

Studies of cutting by electric pulsed discharges were carried out on a test laboratory facility, consisting of a source of high pulsed voltage, a two-rod electrode system placed in a tank with water ($\gamma \approx 300$ μS*cm), and an electromechanical reversible drive that moves the electrode system in the direction of the cut [2]. The removal of chipped rock from the treatment zone was carried out using a flushing system.

The main disadvantage of the pulsed voltage sources previously used in electric pulse cutting machines was that the pulse repetition rate of the generators (made according to the Marx scheme) is low and the destruction productivity and cutting speed were limited as a result.

In this work a generator based on a pulse transformer with a stored energy of up to 140 J, an output voltage of up to 160 kV, and a pulse repetition rate of up to 25 pulses/s was used for the first time as a source of high-voltage pulses. The generator circuit with slight differences is similar to that described in [3].

Fig.1. Photograph of a cut slit in granite.

On the experimental bench, slits were obtained in granite (Fig. 1) and sandstone with a total area of about 800 cm^2. The distance between the electrodes in the experiments with sandstone was 9 mm, with granite, 8.5 mm. The average depth of destruction in one pass of the electrode system was 6 mm. A sieve analysis of the granite sludge obtained during cutting was carried out, which showed that the proportion of “fine” sludge (less than 2.5 mm) exceeds 85%. This with such an interelectrode gap indicates overgrinding, most likely due to insufficient flushing performance, which reduces the productivity of the cutting [4].

Experiments have shown the possibility of using pulse generators with low energy and a high pulse repetition rate in the electric pulse cutting method, while the mechanical system for moving the electrodes and flushing performance needs to be improved to increase productivity.

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