

*Materials of Conferences*

**BASIC IDEA, PURPOSE, PROBLEMS AND  
NOVELTY OF NATURAL STONE  
BRAKING-OUT TECHNOLOGIES USING  
PLASTIC SUBSTANCES**

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It is known that the introduction of new approaches able to meet competition into the theory and development practice of mining solid minerals and also industrial and civil construction promotes their further development. In this connection the idea of creation of effective natural stone breaking-out and solid-cast stone building structures demolition technologies based on new principles of brittle materials destruction with plastic substances is progressive. Thereat, various purposes can be pursued; the main one is natural and artificial stone destruction process efficiency upgrading by means of breaking-out technologies using plastic substances in the mode of their impact displacement from shot holes into the cracks being formed.

In this connection it is necessary to solve the following main problems:

- to analyse the current methods, technologies and equipment serving to break-out block stone, and also to define their perspectives;
- to analyse the method of brittle materials directed destruction with plastic substances and define their perspectives in the area of natural stone destruction;
- to substantiate the parameters of block stone impact breaking-out technologies using plastic substances;
- to verify the parameters of block stone impact breaking-out technologies experimentally in laboratory conditions;
- to develop the block stone breaking-out technologies using plastic substances;
- to verify the block stone breaking-out technologies using plastic substances in conditions of mineral deposits open-cut mining method;
- to find extra areas of brittle materials destruction technologies effective application, using plastic substances;
- to develop and verify experimentally the brittle materials destruction technologies using plastic substances in extra areas of their effective application for the conditions of mining and building practice;
- to substantiate the block stone breaking-out technologies using plastic substances on the factors of environmental and labour safety for the mineral deposits open-cut mining method;

The conclusions about the following are ones of the first to be received in the course of theoretical research proved by the practice:

- the application area of the brittle materials directed destruction method using plastic substances in the mode of their impact displacement from shot holes into the cracks being formed at the block stone breaking-out is defined by the formations of any composition and properties, and the efficiency – by the parameters of hardware components and work performance technologies;

- the development of the crack being formed along the shot hole axis in the course of brittle materials impact destruction with plastic substances is connected with a gradual change of its form from an ellipse to a round, and across the shot hole axis it is of circular character and doesn't depend on its dimensions' further increase;

- the energy of a single impact of the instrument serving to form directed cracks using plastic substances in brittle materials should be minimal and not exceed 100 J on the condition that, taking into account the destructive agencies applied, its size is sufficient to begin the development and make these cracks of required dimensions;

- the influence of mining on the environmental and labour conditions at the block stone breaking-out decreases at the change of any well-known methods of its destruction to a mechanized variant of the brittle materials destruction method using plastic substances or other drilling-and-wedge ones.

The scientific novelty of these results consists in the following:

- it is proved that the crack being formed by discharging a plastic substance into it from the shot hole by a jib-stick develops symmetrically about its axis and, with the growth, tends to the form of a round, the center of which is shifted into the depth of the body destroyed;

- it is proved that the maximal pressure in the plastic substance at the moment of impact load application appears in the area of its contact with the jib-stick;

- it is proved that the maximal distance from the shot hole axis to the crack border and zone of its filling with a plastic substance corresponds to the jib-stick end location;

- it is proved that the dimensions of the crack being formed are defined by the amount of the displaced plastic substance, its flow properties, loading application character and physical parameters of the solid body destroyed;

- it is proved that in case of external loading application to a brittle material sample destroyed using plastic substances the preferential growth of the crack's dimensions and zone of its filling with the plastic substance will occur in the direction parallel to the direction of this loading application;

- it is proved experimentally that an approximate definition of the dimensions of the crack produced by the impact method using plastic substances

can be performed by the calculation based on the principles of quasi-static displacement of plastic substances from shot holes into the formed cracks on the condition of their spending small quantity and uniformity;

- the empirical dependence associating the instrument single impact energy and average volume of the plastic substance introduced to the formed crack at a single impact and rendering possible to define the brittle materials destruction process rate has been suggested and verified experimentally.

The practical value of the performed work carried out at the initial stage consists in the substantiation of the equipment and materials serving for rock failure using plastic substances by the method of their impact displacement from shot holes to the cracks being formed, and the development and implementation of appropriate technologies of work performance at a range of mining and construction enterprises.

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#### **BASIC PRINCIPLES OF MINERAL DEPOSITS EXPLOITATION ENVIRONMENT AND LABOUR CONDITIONS IMPACT EVALUATION**

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In is known that the mining practice impact on the surrounding grounds environment and human goes on simultaneously in several directions. It conditions the necessity of developing a methodological approach allowing carrying out an integral assessment of mining practice environment and working conditions impact. Due to the research carried out by us the general principles of such impact assessment have been developed, they being represented below.

The comparative evaluation of mining practice technologies' environmental impact is necessary to carry out in terms of emissions, toxic substances pumping, and also land resources (soils) outtake, mineral wealth disturbance and solid wastes formation ignoring the efficiency of potential means of collective protection.

The cap stone breaking-out technologies based on the application of plastic substances together with other drill-and-wedge methods are the safest ones,

when speaking on the environmental conditions impact.

To bring the compared mining operations into the matching appearance according to the environmental impact principle they are necessary to be considered in the light of: the same mining method application; the same natural media perceiving the influence of certain elemental composition contaminants being formed; the same aggregative state of the considered contaminants; the same target purpose of the considered mining processes conditioning the appearance and subsequent influence of the contaminants being formed.

The cap stone breaking-out technologies based on the application of plastic substances are connected with other methods of cap stone breaking-out by the only common process – drilling, that makes possible to compare them according to emissions of dust and vapors of oils used for the drilling technique work.

The comparative evaluation of mining technologies' influence on labour conditions needs to be carried out in terms of safety methods and industrial sanitation of the work performance ignoring the efficiency of potential means of collective protection.

The cap stone breaking-out technologies based on the application of plastic substances together with other drill-and-wedge methods are the safest ones, when speaking on the labour conditions impact.

As the only common process connecting the cap stone breaking-out technologies using plastic substances with other breaking-out methods is drilling, the comparison with them on the labour conditions impact should be carried out in terms of noise, vibration of the equipment applied, safe working methods, severity and intensity of work, as well.

At the comparative evaluation of mining technologies serving for cap stone breaking-out, the impacts associated with the contaminants, the concentration of which can be measured (calculated) with the help of their concentrations, should be referred to the environmental safety area, as their impact is beyond the scope of a spatial working place.

At the comparative evaluation of mining technologies serving for cap stone breaking-out, the impacts associated with the contaminants, the concentration of which can be measured (calculated) with the help of impact levels, should be referred to the work safety area, as their impact, in most cases, is not beyond the scope of a spatial working place.

For the purpose of bringing the comparison elements described with numeric values into the matching appearance they need to be reduced to the factors of time, finished commodity volumes or both time and volume of finished commodity.

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