Journal of Engineering and Applied Sciences 1 (4): 434-436, 2006

On the Influence of Crack Direction of the Rocks Massif on Degrees of It's Crushing by Explosion

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Abstract: Discontinuities are one of the factor causing the reduction of the resistance of the rocks to the destruction to the explosive. Nevertheless, the distance between the cracks their slope and the position of the detonator play a significant role as for the final result of the fragmentation of the rock. In our investigation, to study the phenomenon of the destruction of the rocks to the explosive and to determine the role of the factors quoted previously, we prepared models starting from the limestone rock. The results of the tests show a perfect correlation with the results obtained under the conditions of the mines of Algeria and those establish by Kouznitsov-Ramlèr.

Key words: Fragmentation of the rocks, modeling, blast hole, demolition with the explosive

INTRODUCTION

Cracking is one of the major factors causing decrease of resistibility of rocks massif to destruction, in comparison with a monolithic massif[1-3]. At explosive retreat influence of cracks in a massif on a degree of its crushing in many respects depends on distance between the next cracks, width of cracks and their relative positioning[4].

Destruction of cracked massif of rocks basically occurs on cracks and on the monolithic blocks in less, witch are generated between cracks naturally. Thus, as the cracks of breaking massif are in more deep and thick grid, the size of the parried mountain heap is being less[5-8]. This phenomenon is most typical for rocks massif which are broken by systems of mutually crossed cracks with relative small distances between them. Notably, physico-mechanical properties of the rocks have a less influence on the crushing degree. However, in conditions of coarse blocks presence formed due to mutual crossing of cracks, having relatively big distances between them, the destruction character of the massif appreciably changes[2,3,9,4,10]. The reason in that located in the blast wave case, witch have been reached the cracks surface, approximately and appreciably from them is reflected, therefore active destruction occurs only in the interval of limited massif by these cracks. The degree of shock wave reflection from the crack surface directly depends on its width. Accordingly, with removal from this zone, intensity of destruction process is sharply weakened. Consequently, rocks massif collapses generally on large pieces which sizes are frequently exceeded those necessary conditioned piece and important re-crushing of natural blocks occurs only in immediate proximity from charges of explosive matter[4-6,9,10].

On the other side, in nature, quite often, there are rocks massifs with a layered structure and, in fact, a parallel arrangement of cracks[7,8,11]. It is typical of rocks having sedimentary origin (limes, slates, salts, etc,.). For such studies the big influence on destruction of rocks massif under action of explosion renders, not only distance between the next cracks, but also their direction and also mutual orientation of explosive chinks and slopes of working ledges.

PREPARATION OF MODELS

For establishing quantitative dependences we had been carried out experimental essays with explosive destruction of physical models. Models were made as ledges (Fig. 1), made from separated, stuck together among themselves plates (thickness of 25 mm), executed of limestone. Before elements destruction, model is investigated with the establishment of limestone basic characteristics, of which they have been made. Results of these tests are showed in Table 1.

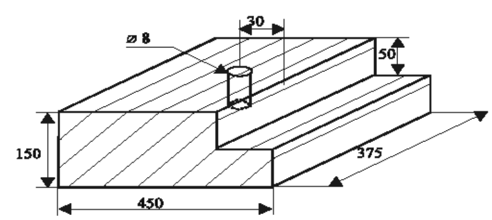

Fig. 1: Model construction from limestone

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Table 1: Results of physical and acoustic tests of models material

Characteristics	Quantity of samples	Average value	Average deviation	КОЭфф. Variations	Relative oversight
Resist limit. one axle direc of compres. MPa	16	80.84	6.24	17.4	9.54
Resist limit to stretching. MPa.	16	40.69	1.93	22.21	12.23
Resist. limit at once. Mpa	16	47.05	0.99	8.96	4.88
Density. g cm^{-3}	16	2.58	0.02	1.27	0.70
Wave longitudinal speed. m/s	16	1040.56	144.15	13.85	7.60
Wave cross speed. m/s	16	600.80	83.23	13.85	7.60

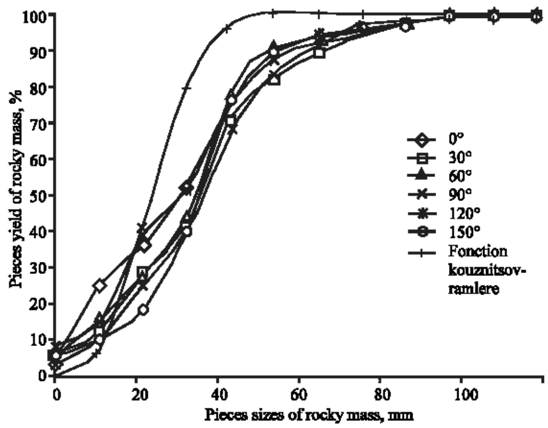

Fig. 2a: The pieces sizes of beaten off roky mass dependence on nackes direction with vertical ledje slop, the disposition of detonator in the midle of vertocal polecat charge of explosive matter

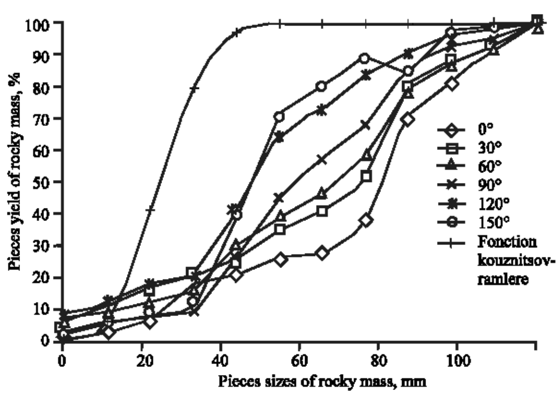

Fig. 2b: The pieces sizes of beaten off roky mass dependence on nackes direction with vertical ledje slop, the disposition of detonator in the midle of inclinated polecat charge of explosive matter

In total 16 models have been made and blown up, differed in inclination angles of cracks system, inclination angle of ledge slope and inclination of chink and also in the location of detonator in the charge of explosive matter. Thus, the inclination angles of cracks were measured

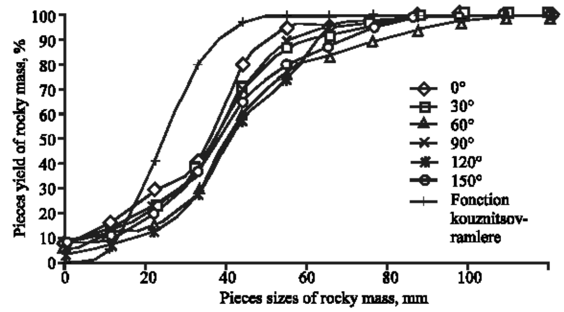

Fig. 2c: The pieces sizes of beaten off roky mass dependence on nackes direction with inclinated ledje slop, the disposition of detonator in the midle of inclinated polecat charge of explosive matter

relatively to horizontal platform, made for different variants 0°, 30°, 69°, 90°, 120° and 150°. As explosive matter, in models were used ammonite, weight of 10 g.

Detonators disposed in the top, the average or down of the charge parts of explosive matter. The line size of the least resistance, in all models has been accepted equal 30 mm.

After explosive destruction of each model, it was made the sieving analysis of the beaten off rocky mass for what used lattices with apertures 0.5, 1.7, 5.1, 12.7, 25.4, 50.8 and 101.6 mm. Average piece diameter of the beaten off rocky mass determined by the following dependence:

$$d_{cp} = \sum_{i=1}^{7} m_i \; n_i \; / m_i$$

m_i-weight or specific value of each coarse class of rock; n_i-the average sizes of each coarse fraction.

RESULTS AND DISCUSSION

As a result of experiments, have been received the data by piece of the beaten off rocky mass and by stinging contours in slope and in the ledges basis. The quantitative analysis of these data has allowed establishing a number of dependences of results explosive stinging from cracks direction massif and other conditions of models invocation (Fig. 2a, b and c).

CONCLUSION

Finally, it is established, that, results of explosive stinging globally depend on the direction of cracks system in rocks massif, the inclination angles of polecat charge of explosive matter in relation to ledge slope and from the location of explosion initiator in the charge of explosive matter. Comparison of the received dependences shows on their certain similarity. Most close curves correspond, the chinks located in parallel to the ledge slope at accommodation of detonator in the middle of the explosive matter charge. The least conformity of experimental and theoretical schedules takes place at discrepancy of inclination angles of chink and ledge slope, especially in cases of using inclined chinks on vertical ledges.

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