

Development of cracks at the different large-scale levels at dynamic impact on rocks

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Scientific bases of safety of mining operations mean studying of the nature and the reasons of formation of emergencies and also development of ways and means according to prevention of catastrophic events, including in the form of mountain blows, the collapse of rocks, etc. In this regard security of mining operations and a problem of destruction, are inseparably linked. At the seeming simplicity of destruction its mechanism is very difficult and covers huge area on a scale of the sizes, beginning from atomic scale, and comes to the end with visual manifestations. Within modern representations destruction of materials is nonequilibrium space-time process of the accumulation of damageability caused by education and development of a time and cracks, multi-scale by the sizes, which nature consists in microscopic inhomogeneity of materials and their structural features. For a research influence of structural features of rocks on process of destruction are conducted laboratory a research within which dynamic impact on samples of rocks was modelled by detonation of microcharges of Teng in the camouflage mode. By means of modern methods of a physical experiment of the optical, laser scanning confocal and electronic microscopy it is executed studying of elements of structure of rocks and its evolution in the conditions of dynamic influence. Images of defects at the different large-scale levels in a 3D format are for the first time received and their parameters are determined. Within the experiment after dynamic influence except microcracks formation of extended radial macrocracks by length several centimeters which development contacts a gas factor was observed. The twisting form of a crack at the initial stage of its development can demonstrate change of speed of its distribution or, more precisely, about delays in its development that, obviously, is connected with formation of a zone of localization of destruction at its top and the subsequent spasmodic advance. The delay in development of the main crack allows to be formed during this time due to development of microdefects, smaller cracks in volume of a sample. In marble in breed with a uniform microstructure, unlike granite multiple cracking was not observed, cracks had a rectilinear trajectory, there were more extended, but not numerous and practically reached borders of samples. The method micro and nanoindentings, Jung's module allowing to define and hardness at various large-scale levels and also viscosity of destruction of separate mineral components was applied to assessment of mechanical properties and structural heterogeneity of samples. Results of the researches including connected with three-dimensional visualization macro- and microdefects, create prerequisites for development of theoretical models in the field of durability physics for forecasting and management of processes of deformation and destruction of rocks that is the necessary tool for the safest and effective development of a subsoil.