# Methane generation at the coal destruction

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The phenomenon of increased gas emission at sudden outburst of coal and gas has long been known, but there is still no consensus on the causes of this phenomenon.

The abrupt change in the stress-strain state of gas-saturated coal, when moving the working face, starts a chain of processes that can lead to an avalanche-like destruction of coal in the form of a sudden outburst of coal and gas, under certain conditions. An adequate supply of energy (the sum of the energy of elastic compression of coal and the energy of expanding methane) is necessary, which can be realized in the process of outburst, not less than 0.2÷0.3 MJ / $m^3$. The rate of stress change (jump) should not be lower than 1÷3 MPa / s, that is, higher than the relaxation rate of the new stress-strain state of the massif. At the same time, the massif is oversaturated with the energy of coal elastic compression due to the abrupt drop in its strength and the energy of expanding free gas, the amount of which sharply increases due to volume increase of desorbed methane into the expanding cracks and macropores. Wherein the nature of the destruction in a decisive way depends on the magnitude and speed of the removal of lateral stress from the side of the face.

Made assessments of the consumed and expended energy in these processes suggest that expanding methane can not only mechanically destroy coal by separation and carry it into excavation. Chemically bound methane, being released, can change the structure of coal, breaking off weak bonds in its aliphatic part, the "fringe" of the coal substance. In this case, the destruction of coal occurs at the intramolecular level, formed fragments of the "fringe" are free radicals.

Experimental studies have shown that the molecules of the coal substance lose a significant part of the aliphatic CH3 groups, the detached radicals (CH3 groups) are chemically active and can, together with at least active atomic hydrogen, also detached from the fringe of the coal molecule, form methane. That is, at a sudden outburst as a result of mechanochemical processes, occurs something like an accelerated metamorphism of coal with the formation of methane. This is confirmed by the fact that the technical analysis of coal from the outburst area showed that the fine coal fractions contain less volatile substances in its composition, that is, the smaller fraction, which is the more destroyed coal, is more metamorphosed.

Methane formation occurs during plastic destruction of coal under conditions of sufficiently high stresses, when the minimum principal stress is not less than 5 MPa; and the maximum principal stress exceeds it not less than three times. The amount of formed methane depends on the conditions of coal destruction.