PECULIARITIES OF DETONATION OF GAS SENSITIZED EMULSION EXPLOSIVE

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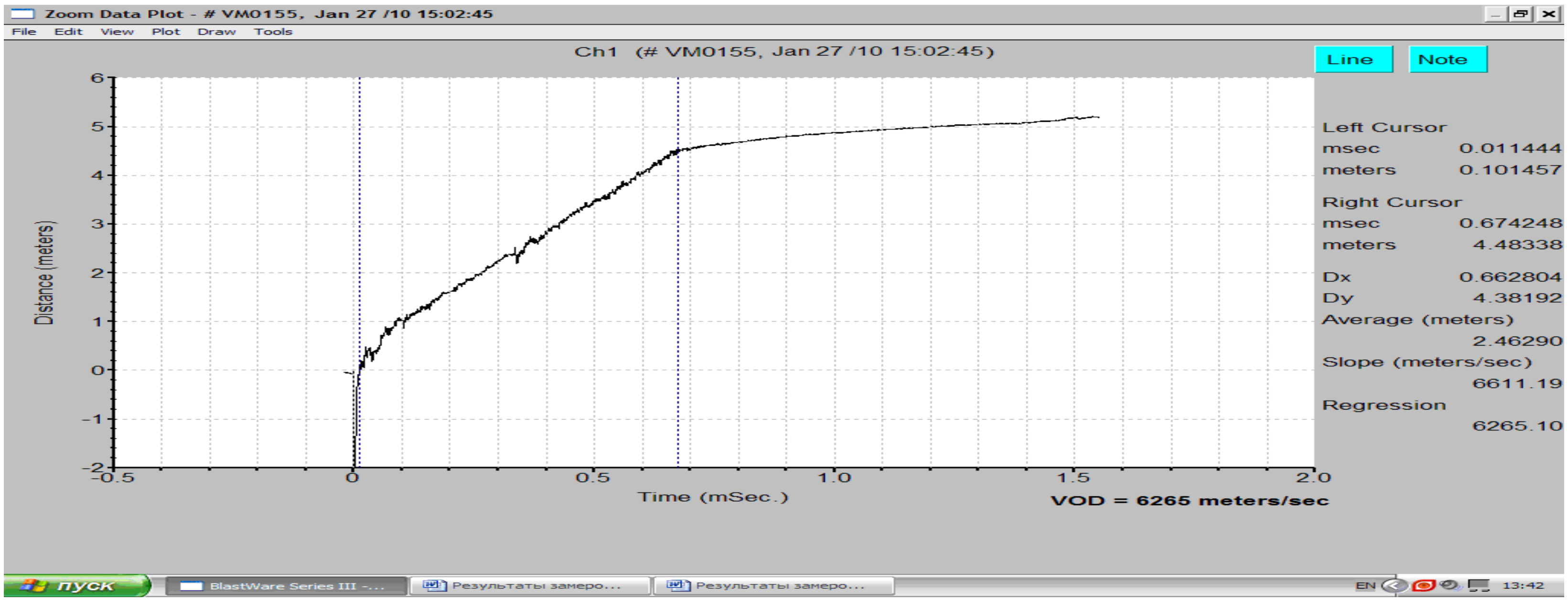
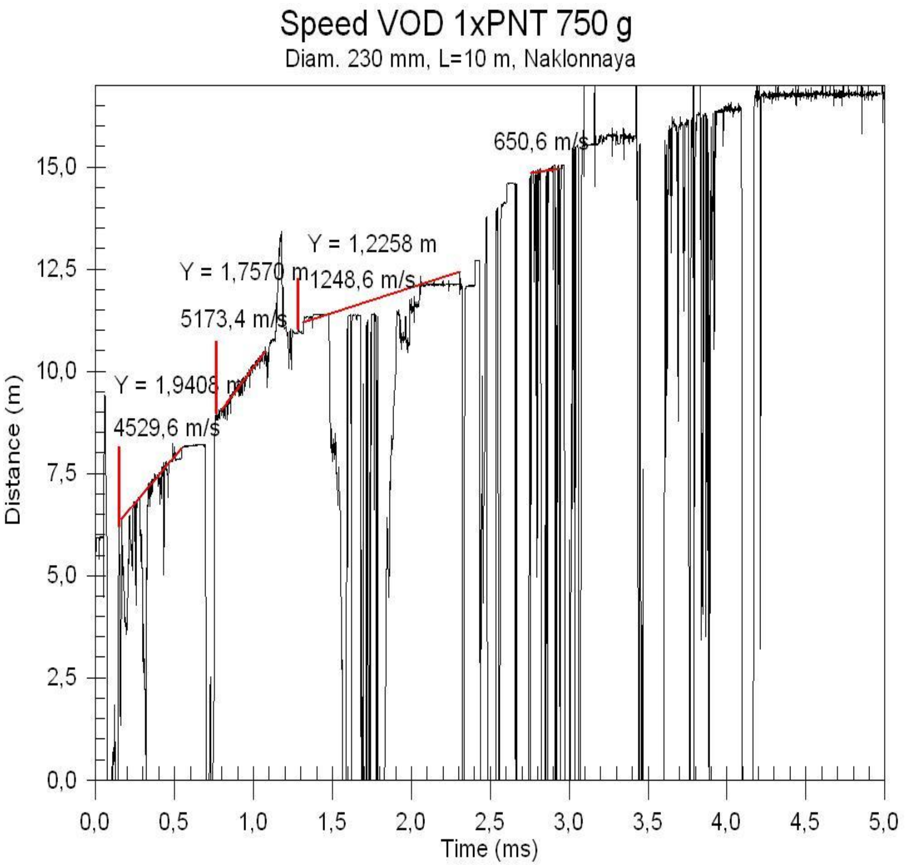
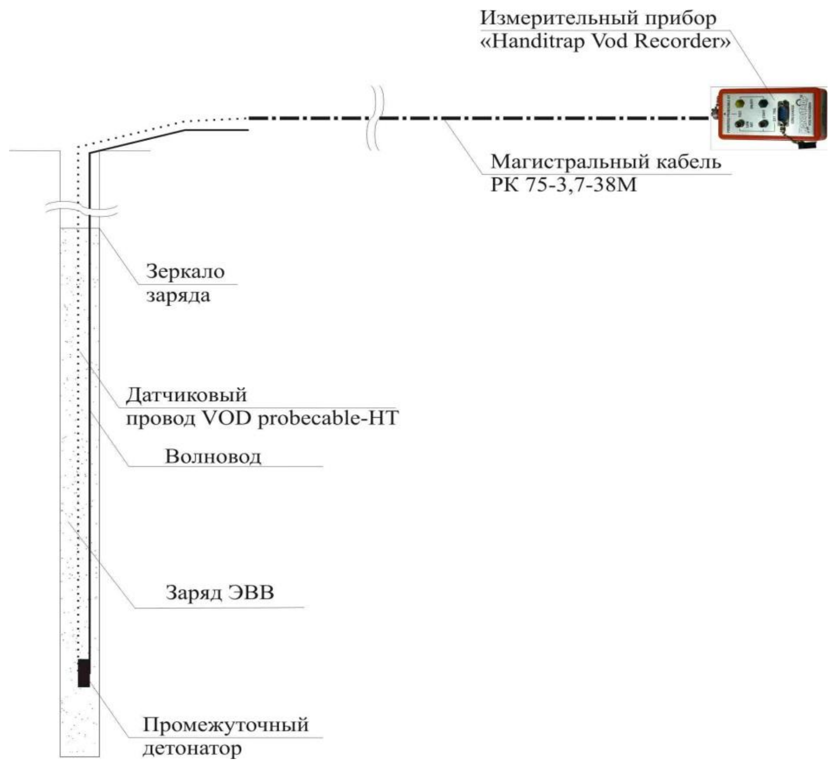
Experiments Shemenev B. (Urals, Sibai, 2010). (73,2% $NH_4 NO_3$ + 2,4% $CO (NH_2)_2$ + 18% H_2O + 6,4% fuel and emulsifier)



- Hole depth: 14 meters. Length of charge: 6.5 m. Diameter hole 250 mm.
- The established detonation velocity in the well is 6108 m / s.
- Detonationg primer : 0,5 kg TNT x 2 piece and aditional winding checkers detonating cord.
- With this method of initiation there was a powerful initial acceleration. Further attenuation of the detonation velocity and the transition at the end of a burning.

Experiment. Urals. Mining of Asbestos (2012)

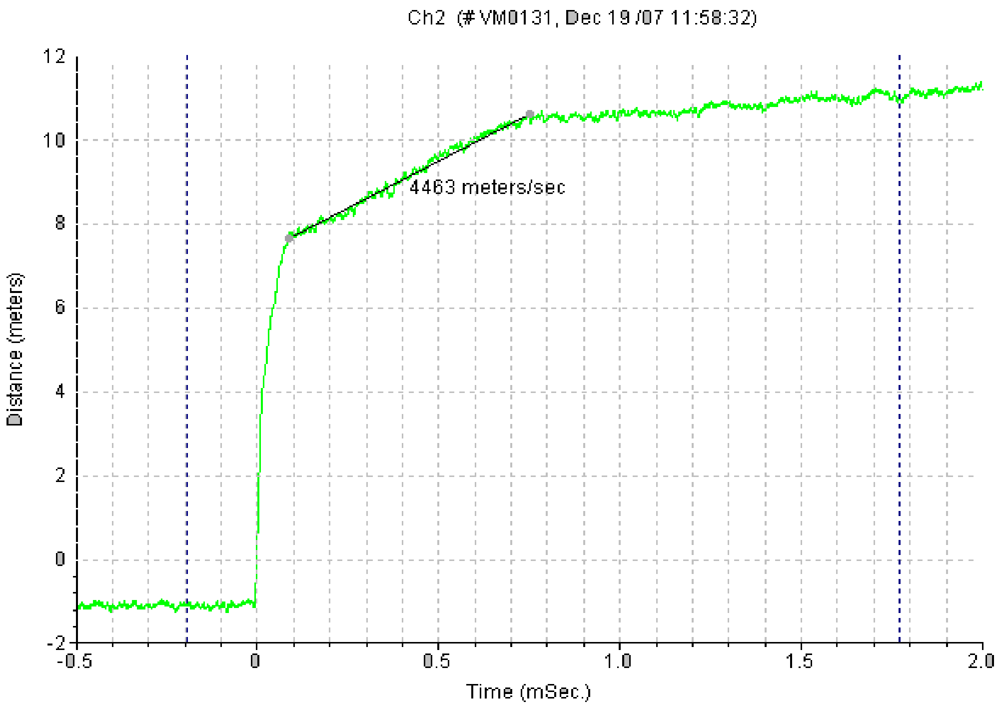


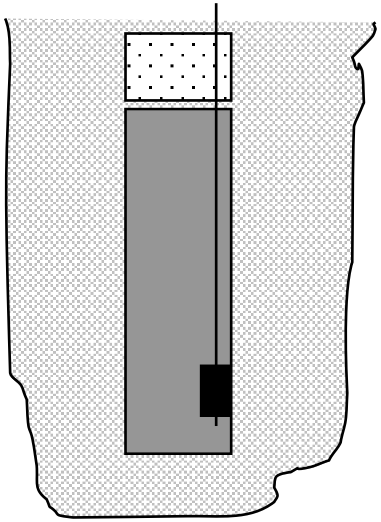


Dependence of the mean (m) of the charge diameter of 250 mm from the detonation time (ms) EE (74,8% NH4 NO3 + 18% H2O + 7,4% fuel and emulsifier)

Detonationg primer: 0,85 kg pentolit x 1 piece

Experiments V.Kuprin (Ukraine, South Mine, 2007) (43% NH4 NO3 +32% Ca (NO3) 2 + 16% H2O + 9% fuel and emulsifier)

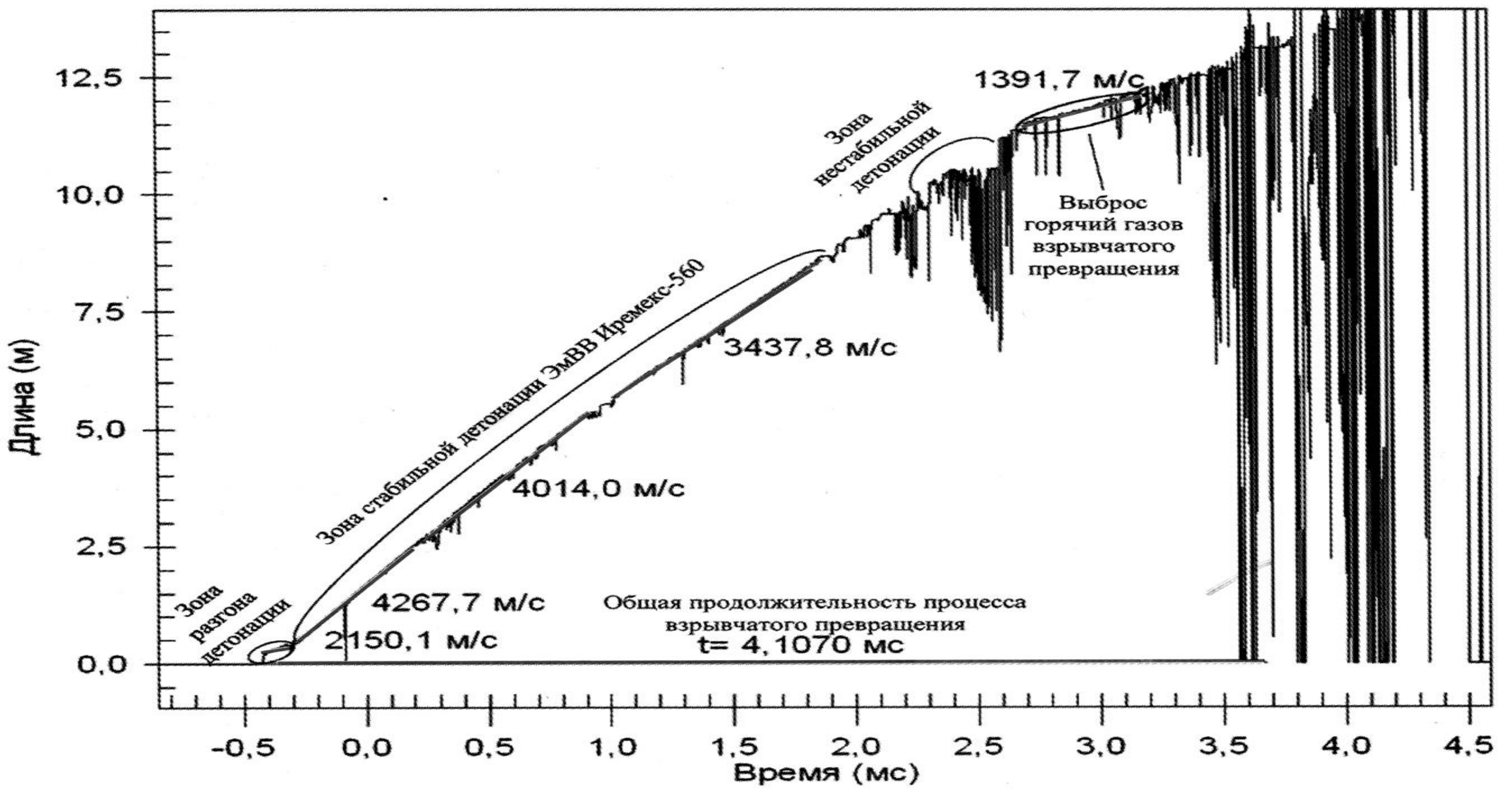




Hole depth - 19.5 m **Charge length - 12m.**

Hole diameter - 250mm. **Detonation primer – 0,85 kg TNT x 2pcs**

Experiments Bondarenko (Aikhal Mineral Mining, 2011). IREMEKS-560

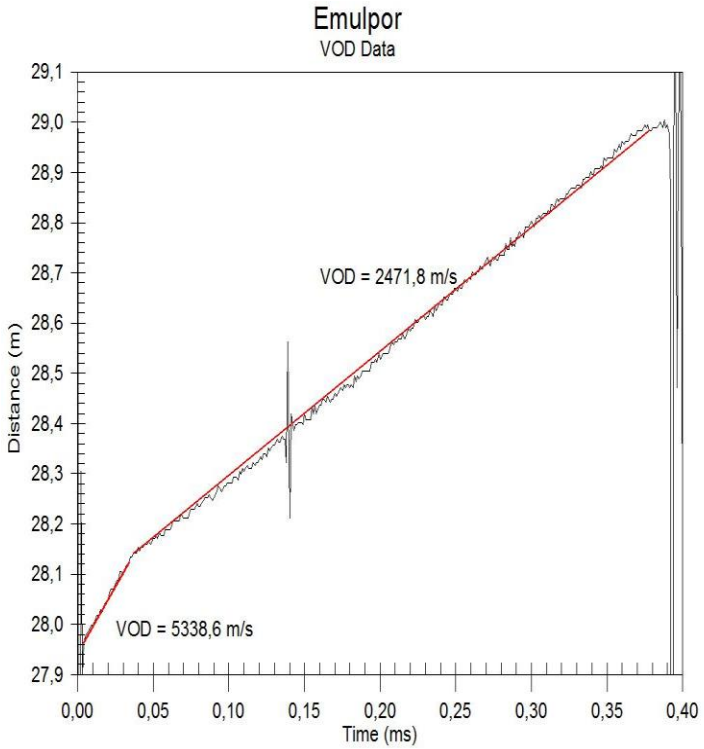


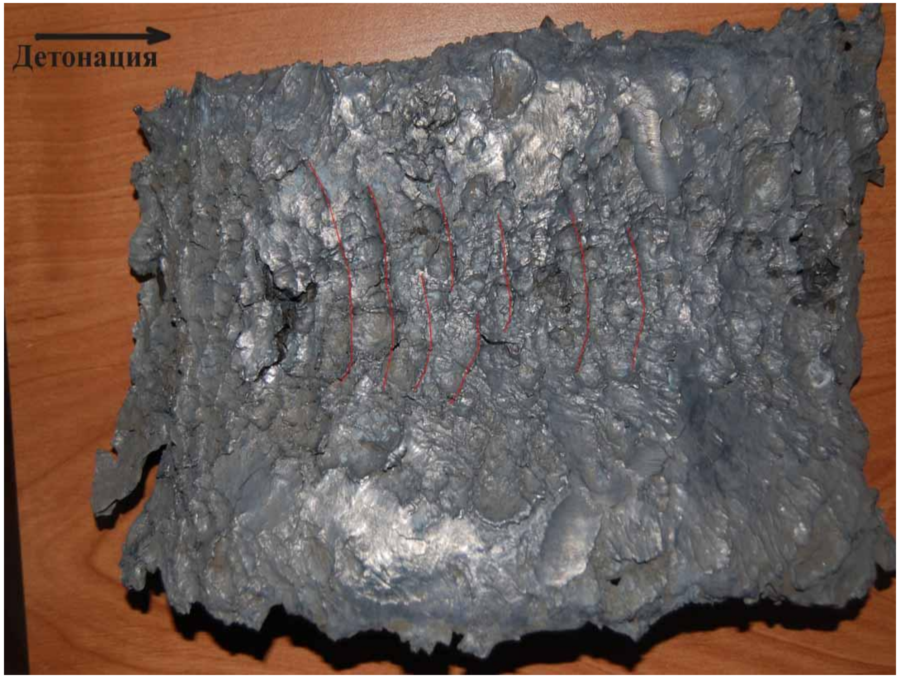
- **Detonation velocity was measured by the explosion of single shot hole.**
- **Charge length 12-13m. Conditional loss EE - 10-15%.**

Findings from experimental studies

1. Loss of detonation of emulsion explosives is observed at different chemical composition of the explosives.
2. Breaks detonation, the distance passed dozens of calibers.
3. Loss of detonation can not be explained by violation of the technology of manufacturing an explosive or a violation of the charging process.
4. Loss of detonation can not be explained by a violation of cables for measurement.

Data on the structure of the detonation wave, obtained by imprint

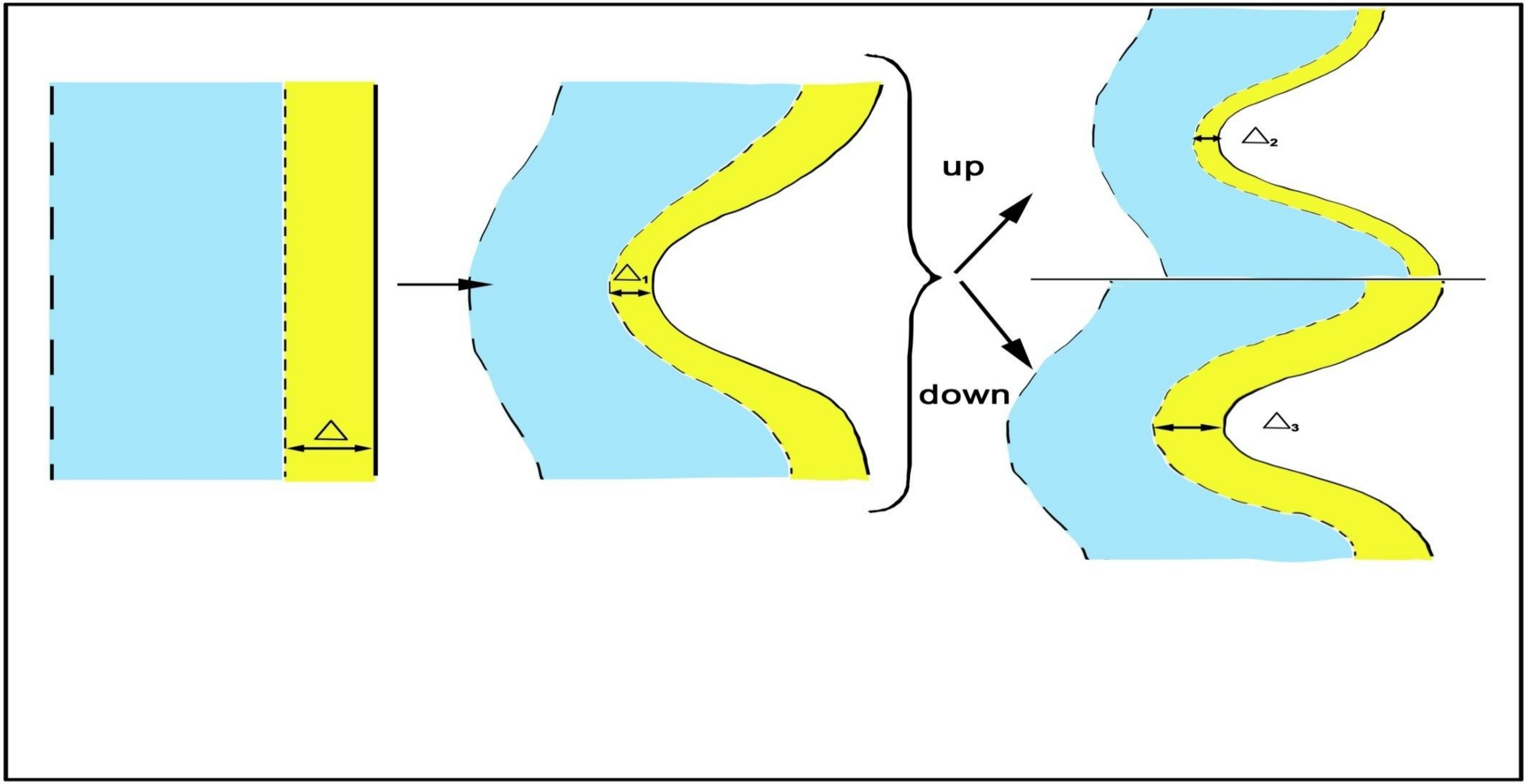




- **Detonationg primer : 0,25 kg ammonite №6 x 1 piece**
- **Length of charge: 1.0 m. Diameter hole 90 mm.**


Детонация

The evolution of the reaction zone in the propagation of a detonation wave



Evaluative criterion symptoms of corrugators instability

- **Proposed for assessment calculations (using analytical corrugators instability, proposed by Pavlov V., serious difficulties due to the lack of detailed thermodynamic description of the explosive EE)**

$$k_{\text{ãîôô}} = \frac{\frac{v^2}{c^2}+\frac{vD_*}{c^2}-1}{1-\frac{v^2}{c^2}+\frac{vD_*}{c^2}} - \frac{D_*^2}{V_{oo}^2}\frac{V_f}{nP_f+k_*}$$

$$k_{\text{ãîôô}} > 0$$

$$n_* = \frac{D_*}{W^{/}} - 1$$

$$k_{\text{ãîôð}} = \frac{\left(1+\frac{V_f}{V_{00}}\right)\frac{V_f}{V_{00}}\left(\frac{D_*}{c}\right)^2 - 1}{\left(1-\frac{V_f}{V_{00}}\right)\frac{V_f}{V_{00}}\left(\frac{D_*}{c}\right)^2 + 1} - \frac{V_0 - V_f}{V_0 + V_f}\left(\frac{V_0}{V_f}\left(n_* + 1\right) - 1\right) > 0$$

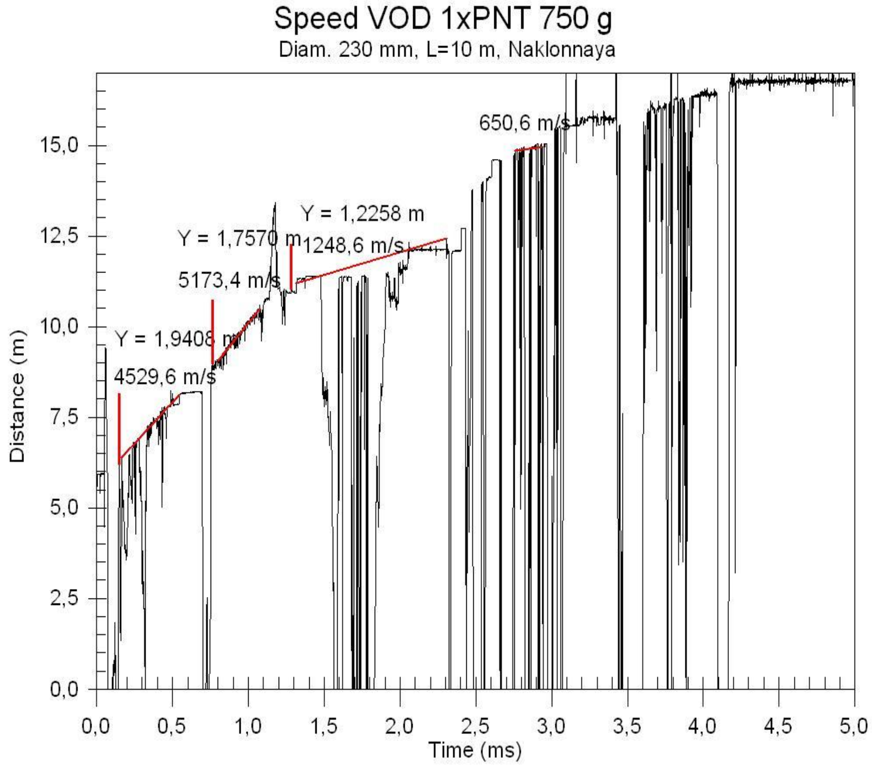
Disruption detonation transition zone Kgofr. <0 because the overdriven detonation mode is provided "pumping" energy of the reaction in the gas fields of convex bodies (downstream). This creates a high energy density in these parts of the reaction zone and decreases in others.

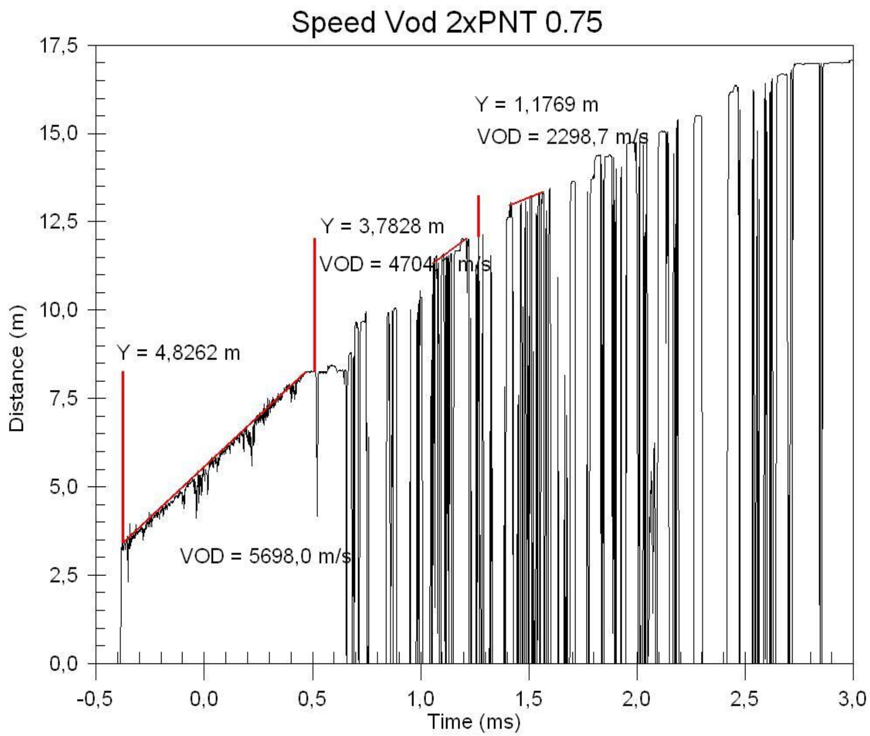
Therefore, the liquidation pressure ripple in the remaining parts of the reaction zone is not enough to maintain the high speed mode. In the reaction zone, the temperature falls, slowing the chemical reactions. This leads to a sharp increase of the limit and the critical diameter.

As a result, there is a rapid decrease in the rate of detonation up to a full stop the detonation process.

It is clear that there is a maximum degree of recompression defined by the conditions of thermal explosion of the explosive material in the compression zone and (or) the characteristics of the exciting pulse.

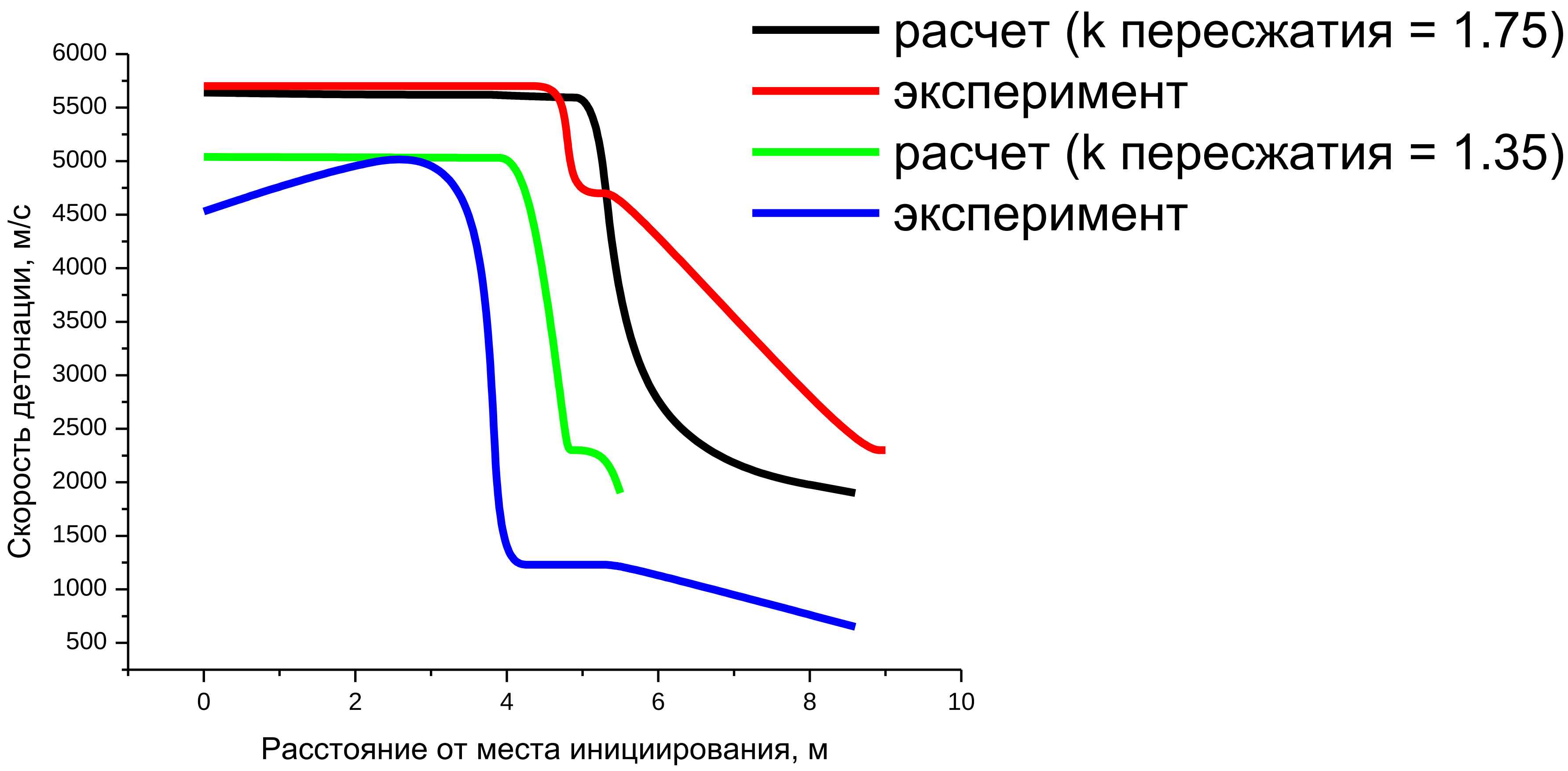
Influence on the course of the initiating pulse detonation process





- **Borehole diameter of 250 mm. EVV "Poremit 1A." Number 1. Detonationg primer: 0,85 kg pentolit x 1 piece**
- **Borehole diameter of 250 mm. EVV "Poremit 1A." Number 2. Detonationg primer: 0,85 kg pentolit x 2 piece**

Calculated dependence of the velocity of detonation of emulsion explosives removal from the site of initiation (lower initiation, the distance from the top of the detonationg primer - 8m, EE density at atmospheric pressure - 1g/sm3, the ratio of the radius of the pores of the particle size emulsion - 20, the chemical composition of EE – NH4NO3 - 73,8%, H2O - 18,5%, fuel and emulsifier - 7.7%)



Conclusions

Print method shows that the detonation of emulsion explosives covered in pulse mode;

The hypothesis that the destruction of the corrugation of the detonation front possible failure of detonation (or switching to low-speed mode) allows you to get the estimated results are consistent with experimental data. This hypothesis additionally allows to explain:

1. **Very high detonation velocities EE (more than 5-6km/s)**
2. **Worlds practices of application more powerful detonation primers for initiation of EE**

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