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EFFECT OF HYDROSTATIC PRESSURE ON THE THERMAL DECOMPOSITION OF HIGH EXPLOSIVES

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At the 6th Annual Meeting of European Research Group at Cadarache in 1968,[x] we related that experiments with solid transmitting pressure conditions (fig. 1) had shown it was possible to get a fast decomposition of high explosives, (fig. 2) if they are subjected to a sufficient pressure. This decomposition was obtained with or without heating, and even at a low temperature. On exemple, R. D. X. results allow us to conclude that : (fig. 3)

- an isotherm or isobar course was indifferent ;
- the decomposition temperature decreased with pressure ;
- the scattering of the results proved these were not reproductible and it shewed that the experiment did not describe a physical phenomenon ; its hasardous character was in fact due to the superposition of several phenomenons.

Then, we thought that these experiments had to be studied again in a hydrostatic cell, so as to eliminate, as far as possible, causes of decomposition other than pressure or temperature.

The hydrostatic cell (fig. 4) includes a nylon container filled with silicon oil. This oil freezes at about 13 kb in the ambient temperature, then becomes thick. Yet, it forms a good transmitting pressure and cancels, among other things, the shearing stress between the transmitter and the sample.

Pressure is marked with a calibration curve drawn by means of the electric transitions of Bi, Th and Ba (with a reserve for the last). This curve is recorded on a computer by the Last Square Method which uses the following equation : (fig. 5)

$$P = k \frac{p}{p+q}\left(1 - e^{-\lambda p}\right)$$

where :

- k, q and λ are constants for each type of cell and belt ;
- P is the pressure in the cell in kb ;
- p " " " on the ram of the press.

The temperature is marked by chromel-alumel thermocouple without e. m. f. correction.

European High Pressure Res. Group, 8th An. Meet. Leeds, Eng.; Apr 14-16

To eliminate the shearing stress between explosives crystals which form the sample, we used single crystals of about 15 mg. This quantity is adequate to signal indisputably the e. m. f. of the thermocouple and the decreasing pressure which follows the explosion does not damage the tools.

Two experimental series on H. M. X. β and R. D. X. conduced to results different from these obtained in 1968. They show the very great importance of the hydrostaticity of pressure, particularly for experiments on sensitive materials (fig. 6).

In fact, this experiment game shows that :

- only the experiments on isobar course arrived at explosive decomposition, which needs a thermic complement of energy ;
- the decomposition temperature slowly increases with pressure ;
- the results are less scattered.

However, these results show that the used measure means are not quite adapted to experiments under great speed reaction.

Then, we are going to take advantage of the X-Ray diffraction equipments and the improvement of measure chains to explain the mecanism of these decompositions, separating the influence of different factors.

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x - R. CAVAILHE Y. SOPHY
6th Annual Meeting of European High Pressure Research Group Cadarache (avril 1968)
" Thermal decomposition of some solid high explosives at a very high pressure".

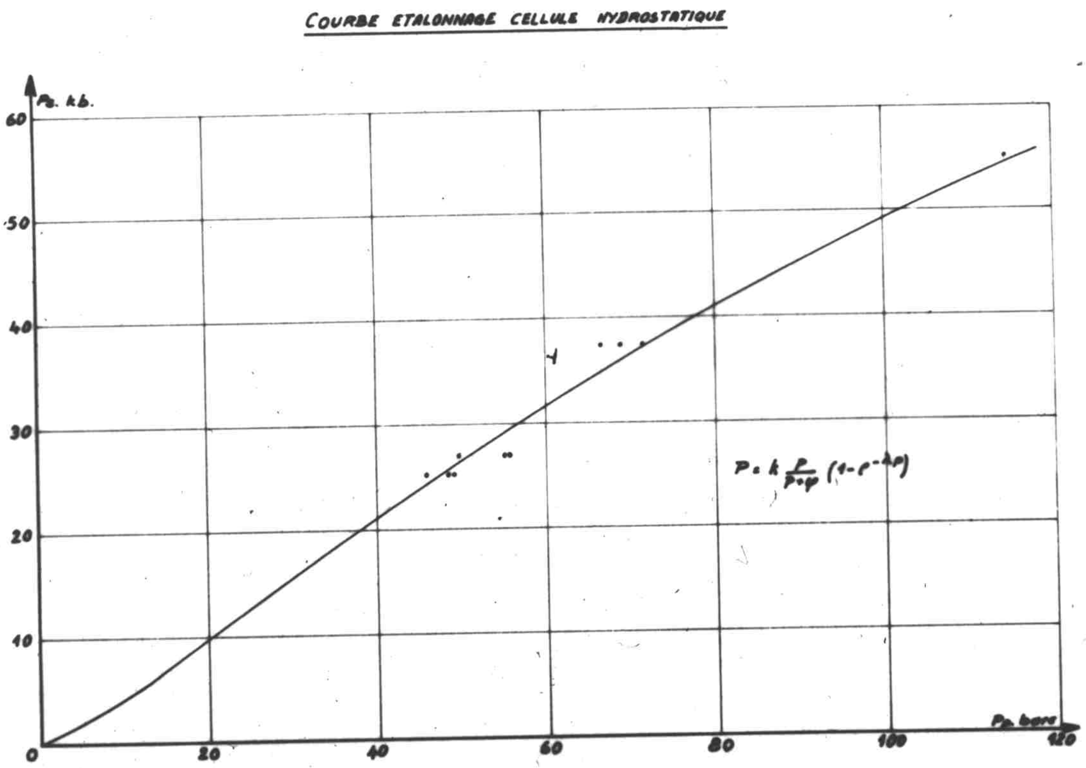


FIG. 5 - CALIBRATION CURVE IN HYDROSTATIC CELL

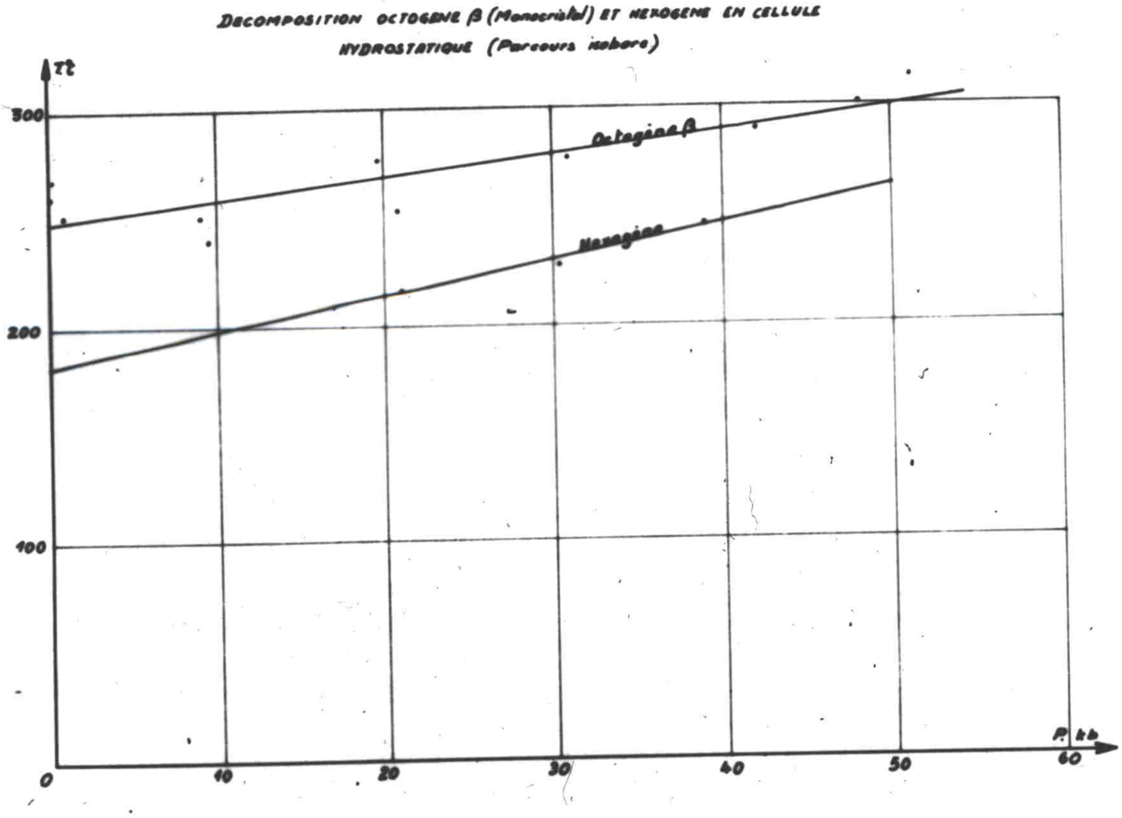


FIG. 6 - THERMAL DECOMPOSITION OF H.M.X. β AND R.D.X. IN HYDROSTATIC CELL

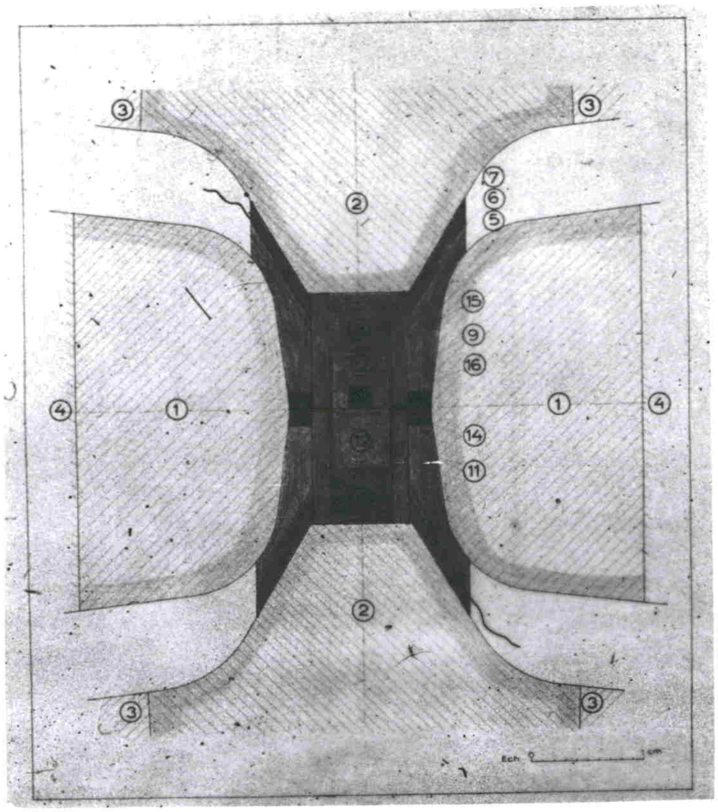


FIG. 1 - CELL WITH SOLID TRANSMITTING PRESSURE

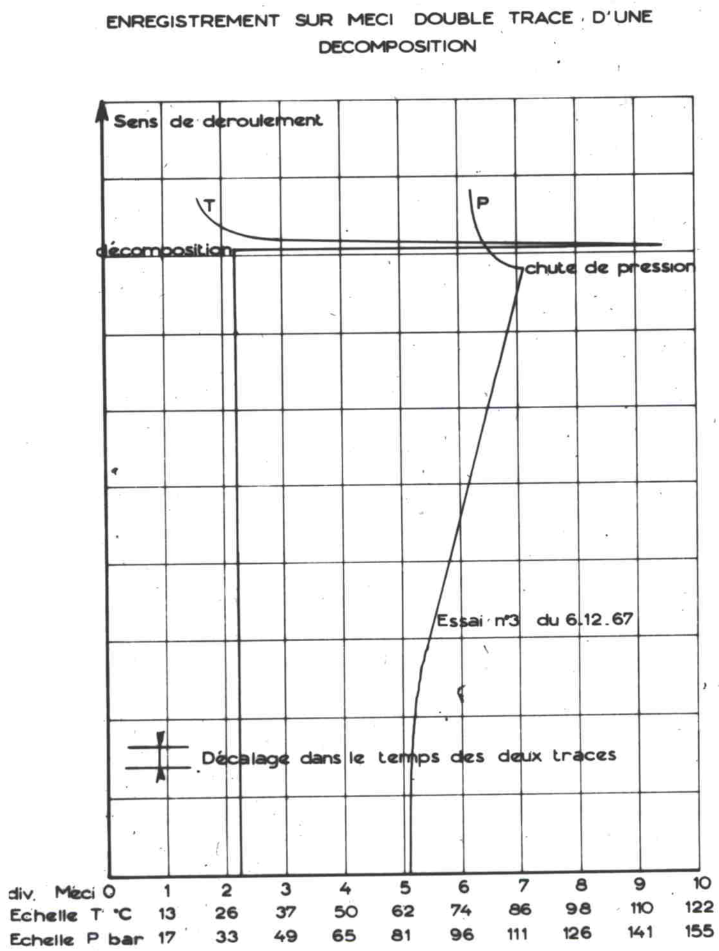


FIG. 2 - THERMAL DECOMPOSITION OF HIGH EXPLOSIVES

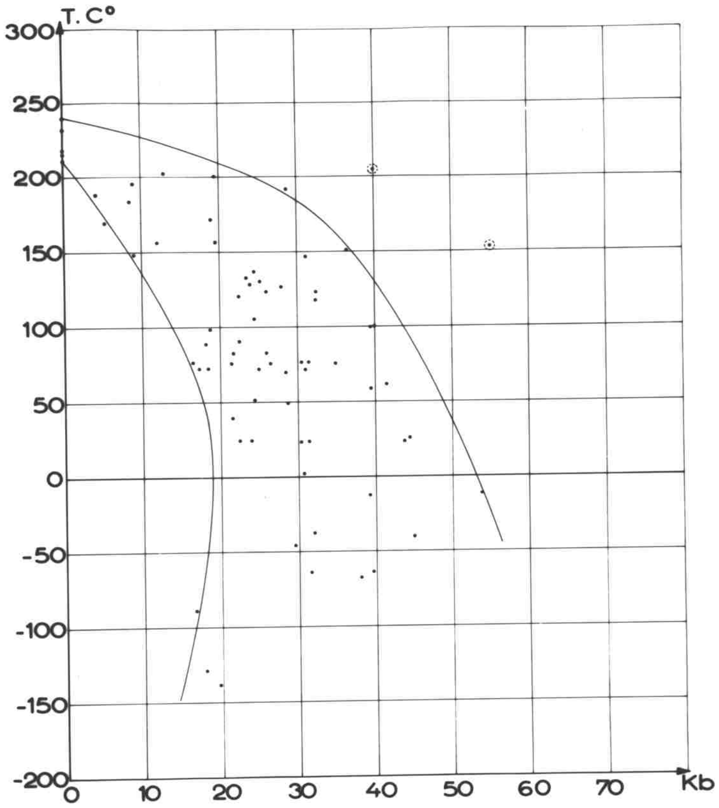
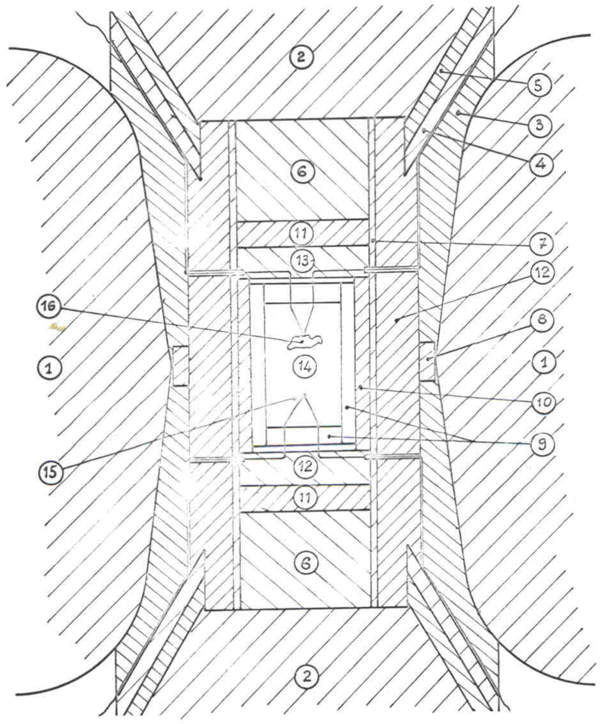


FIG. 3 - THERMAL DECOMPOSITION OF R.D.X. IN CELL WITH SOLID TRANSMITTING PRESSURE



1-coeur CW
2-Pistons CW
3-Cône profilé pyro.
4-Cône métalliques
5- Cône pyro.
6- Cale CW
7-Four
8-Bague Pyro.
9-Enceinte hydro nylon
10-Fourreau pyro
11-Pyro.
12-Pyro.
13-Métollux
14-Fluide
15-Thermocouple
16-Echantillon

FIG. 4 - THE HYDROSTATIC CELL