Synchrotron radiation "in situ" investigation of explosion with nanosecond time resolution

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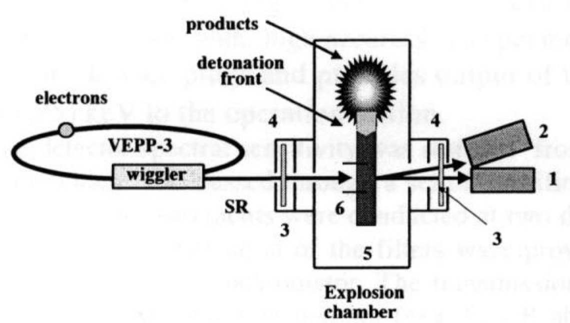

Fig. 2. The scheme of the experiment: 1,2, - transmitted beam and SAXS detectors, beryllium window, 4 – shock wave reducers, 5 - explosive material, 6 - wires detectors as a detonation front sensors.

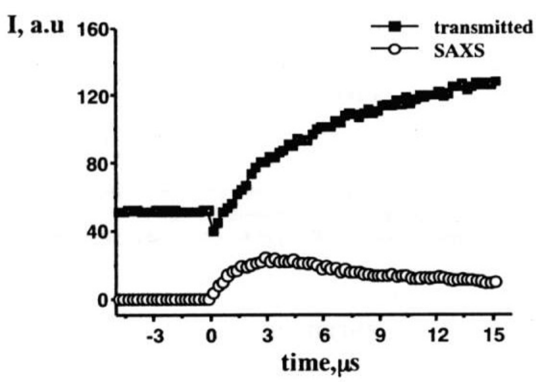

Fig. 2. Experimental results of trotyl detonation. The intensity of the transmitted beam and integral SAXS intensity versus time.

The special instrumentation was developed for investigation of explosion by synchrotron radiation with 250 ns time resolution. This is an explosion chamber, detonation front sensors (wire detectors) and X-ray detectors. The time dependence of the absorption coefficient of the explosive material was measured during the explosion. In the same experiments, the SAXS and the diffraction signal were observed. In the first experiments hexogen–TNT alloy was used to obtain diamond powder as explosion product. In this experiment the SAXS intensity increased sharply for 1500 ns. It is an unusual result, because the theory says that in general chemical transformations finish in about 200 ns.

We have made a lot of experiments with a dozen of different explosives and have found the correlation between the amount of free carbon in explosives products (solid products) and the maximum intensity of SAXS– the bigger the amount of solid products, the bigger is the maximum intensity.

The new scheme of experiment was tested and 60 ns time resolution was resived. The test experiment has shown that it is possible to receive a time resolution of 20 ns. In the report the new schemas with nanosecond and picosecond time resolution will be discussed.

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