# MECHANOCHEMICAL MODEL EXPERIMENTS WITH USING SYNCHROTRON RADIATION

B.P. Tolochko[1], N.Z. Lyakhov[1], I.L. Zhogin, M.R. Sharafutdinov[1], K.A. Ten[2], E.R. Pruuel[2], L.A. Lukyanchikov[2], V.V. Zhulanov[3]

[1] *Institute of Solid State Chemistry and Mechanochemistry SB RAS, Kutateladze, 18, Novosibirsk, 630128, Russia, e-mail: tolochko@inp.nsk.su*

[2] *Institute of Hydrodynamics, Lavrentev, 15, Novosibirsk, 630090, Russia, e-mail: ten@hydro.nsc.su*

The unique characteristics of synchrotron radiations have allowed to design the diagnostics methods of the very fast processes, realized under shock compression in mechanochemistry elementary act with record temporary resolution in 1 ns. The three methods was realized 1) micro-tomography; 2) fast small X-ray angle scattering; 3) fast micro-diffraction. The executed experiments with model object have allowed to get information on real process. For understanding the processes, occurring in material during shock compression treatment, it is necessary to know the equation of the state (ES) for this material. If it is known parameters of compression (the velocity, mass of the bullet) and parameters of ES, than it is possible to calculate the main thermodynamic parameters (a pressure, a temperature and others), reached in sample during mechanochemistry influence. The ES for simple material (Cu, Ni, Ag and others) possible to calculate from the first principle so for some material ES possible to find in literature. For more complex material such as composite material, fractal structures, nano materials and others, the theoretical calculation impossible. In this case ES calculate from data of shock compression experiment. We have executed series of shock compression experiment with different material to receive the parameter of ES. The parameters ES were used by us for calculation of thermodynamic parameter of investigated material, in particular stearates of different metal (Ag, Co, Ni, Zn, Bi, Pb), $SiO_2$, PMMA. The velocity of the shock wave was from 0.4 to 3 km/s.

The method of fast small angle X-ray scattering (FSAXS) with exposures time 1 ns was used for analysis of fluctuation of electrons density during shock compression. In different case the nature of FSAXS was different: in one case this was a development of the system of nano-porous, in the other - a generation and development of the nanoparticles, in the one third - a phase transformation of fractal structures of nanoparticles. Method FSAXS has received unique information on fluctuation of electronic density in adamantane, urotropin, TNT, stearates, $SiO_2$, PMMA. The average size of fluctuation of electronic density (nanoparticles or nano-pours), their distribution on size, average density was received by FSAXS method during shock compression.