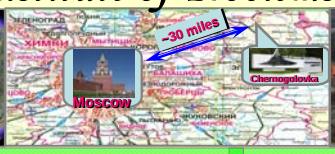
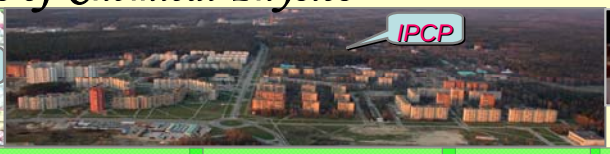
Russian Academy of Sciences
Institute of Problems of Chemical Physics

Where we are





Director IPCP – Vice-President of Russian academy of sciences, academician S.M.Aldoshin

General problems of chemical physics	Structure and properties of molecules, solids and solutions	Chemical physics of combustion and explosion processes. Extreme state of matter	Kinetics and catalysis of complex chemical reactions	Chemical physics of biological systems	Chemical physics of polymers formation and modification

Department of Extreme States of Matter of IPCP RAS

The using of shock wave technique gives us an opportunity to study material properties under 0.001 - 10 Mbar of compression pressures, up to 10000K temperatures, strain rates range over 10^6–10^8 s^{-1} and at uniaxial deformation and stress states close to hydrostatic tension.

Head of Department of Extreme States of Matter academician V.E.Fortov

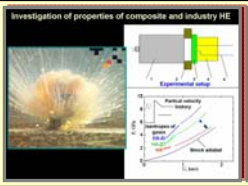
Chemical physics of shock and detonation waves	Physical-chemical substance properties under high dynamic pressures and temperatures	Chemical and phase transitions in shock and detonation waves	Nonideal plasma physics	Conversation of chemical energy of condensed HE in electromagnetic energy	Rheologycal properties of condensed matter under high strain rates and temperatures	Interaction of high energy directional energy fluxs with condensed matter	Conversation of chemical energy of condensed HE in electromagnetic energy	Numerical simulation of pulse processes and thermophysics substance properties under high density energy	Dynamic synthesis of metastable substances

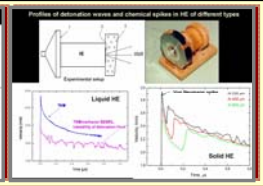
Interaction of high energy fluxes with condensed matter

- Generation and investigation of warm dense matter under intensive heavy ion beam;
- Strength and elastic-plastic properties of solids under nanosecond pulse duration;
- Thermodynamic response of condensed matter to light and heavy ion beam loading;
- Investigation of critical states of matter (melting, evaporation);
- Numerical simulation of interaction of intense ion beams with matter;
- Proton radiography for shock-wave diagnostic;

Detonation phenomena, High Explosive properties and safety

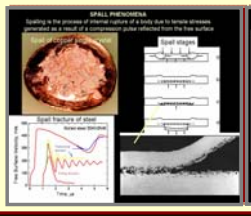
- Properties and structure of detonation waves in heterogeneous and mixture HE;
- Influence of initial density and dispersion on the structure of reaction zone of detonation wave in HE;
- Detonation properties of liquid HE: parameters, initial detonation pressure, critical diameter and front stability of detonation wave;
- Investigations of detonation properties of low sensitive and emulsion HE;
- Investigations of influence of additives on detonation properties of industry HE;

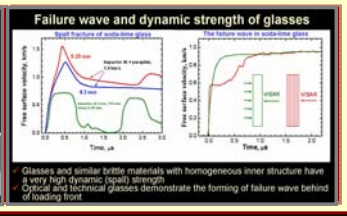




Rheological properties of condensed matter under dynamic compression and tension

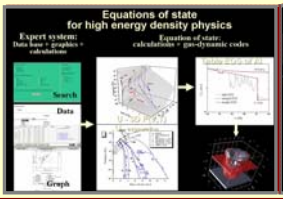
- Strength and elastic-plastic properties of single crystals, metals and alloys, polymers and elastomers, ceramics, composites and liquids over wide range of strain rates ($10^4 s^{-1}$-$10^6 s^{-1}$), dynamic pressures (up to *100 GPa*) and initial temperatures (*77K – 900K*), spall phenomena;
- Investigation of influence of inner structure on material strength properties under shock loading;
- Cavitation processes in liquids under dynamic tension;
- Investigations of mechanisms of fracture and deformation of brittle materials under dynamic compression and tension, criteria of elastic-plastic transition;
- Mechanism of forming and propagation of failure wave in glasses and brittle single crystals under dynamic compression;

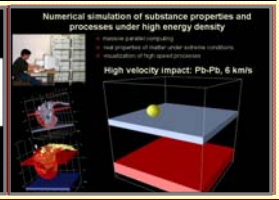




Numerical simulation of high energy density pulse processes

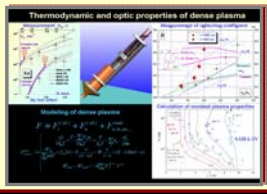
- Development of semi-empirical wide-range multi-phase equations of state of substances (more 150 substances);
- Numerical simulation of hypervelocity impacts of Cosmic bodies (astrophysics phenomena and experiments "Vega", "Deep Impact", "LCROSS", etc.) and supersonic interaction of solids.
- Numerical simulation of interactions of intensive heavy and light ion beams with condensed matter;
- Numerical simulation of nuclear, chemical and explosive safety of civil and industry objects;
- Development of open Shock Wave DataBase (http://www.ficp.ac.ru/rusbank), including thermodynamic properties of substances in shock and isentropic release waves (more 15000 points for ~500 substances);

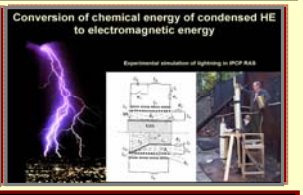




Physics of nonideal plasma and conversation of chemical energy of condensed HE in electromagnetic energy

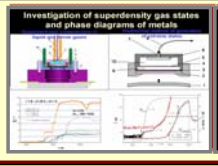
- Development of HE generators of strongly coupled plasma in gases;
- Investigations of reflectivity, spectral composition and temperature of non-ideal plasma;
- Investigation of electrical conductivity and electron density in shock-compressed plasma of noble gases;
- Conversation of HE chemical energy to electromagnetic energy: development of explosive-magnetic generators, high explosive lightning simulation, conversation of HE energy to microwave radiation;
- Theory and modeling of thermophysics of strongly coupled plasmas. Thermodynamics and equations of state of matter of the Sun, stars and giant planets;

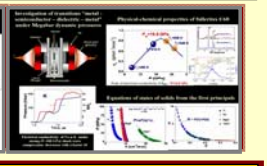




Thermophysical, electrical, optical properties of matter under extreme conditions

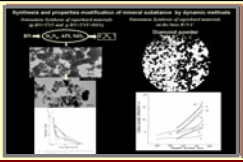
- Trancritical states of metals and oxides;
- Investigation of transport and thermodynamics properties of Hydrogen and Helium under quasi-isentropic compression;
- Electrical conductivity of metals and dielectrics in transition region "metal – dielectric - metal" under dynamic compression at Megabar pressure range;
- Theoretical and experimental study of transport properties at structural and electronic transitions in metals and fullerens;

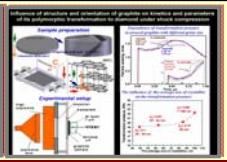




Phase transitions and dynamic synthesis of metastable substances and superhard materials

- Investigation of kinetics and mechanism of polymorphic transition "graphite – diamond" under dynamic compression
- Influence of inner structure, initial temperature and intensity of shock loading on kinetics and parameters of phase transitions of polycrystalline metals and alloys
- Shock wave synthesis of superhard materials: Detonation diamond, BN, BNC, Si_3N_4, C_3N_4





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