National Academy of Sciences of Ukraine

Athens, 10 April 2008

Proposals of Ukrainian Institutions in Physics

- Growth technology
- Fabrication technology
- Devices & Equipment
- Characterization and diagnostic techniques

Growth technology

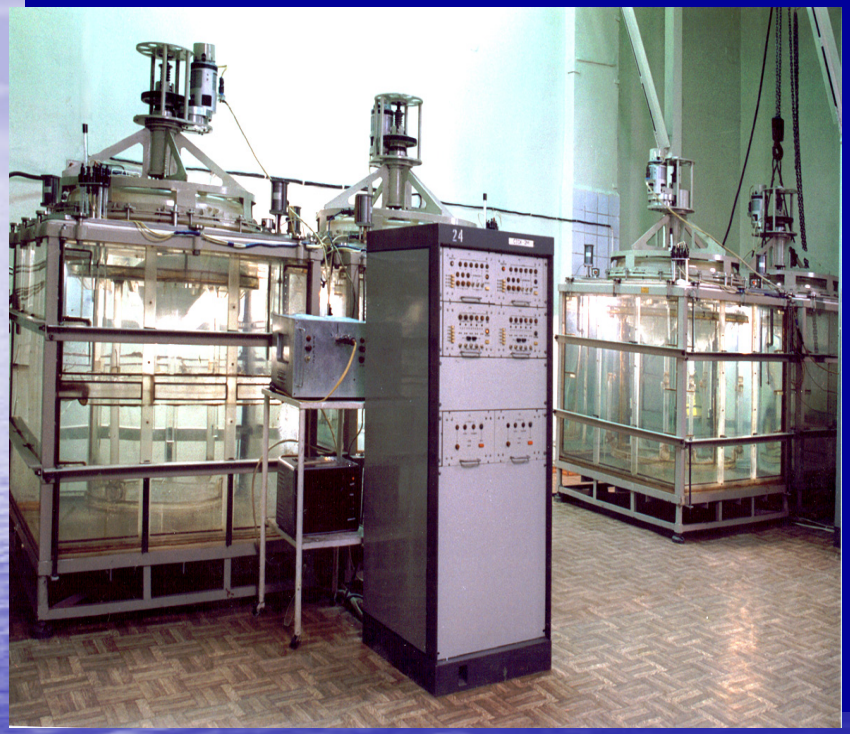
- *Institute for Single Crystals, Kharkov:*

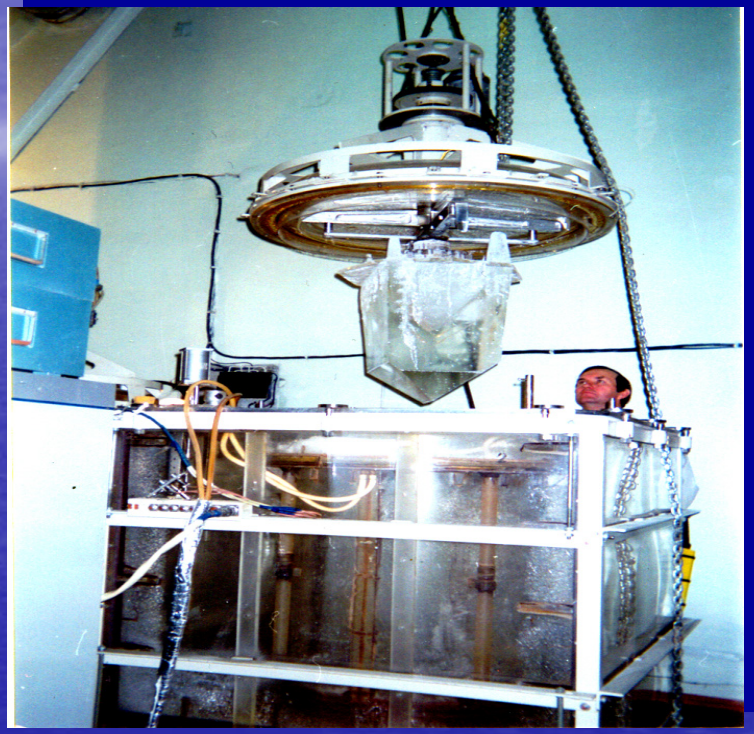
1. Low temperature deposition of SiC films
2. Large KDP crystals with maximum laser damage threshold for high power lasers

Direct Ion Plasma Deposition of the SiC Films

Samples of optical elements with protective SiC films

LARGE KDP CRYSTALS WITH MAXIMUM LASER DAMAGE THRESHOLD FOR HIGH POWER LASERS





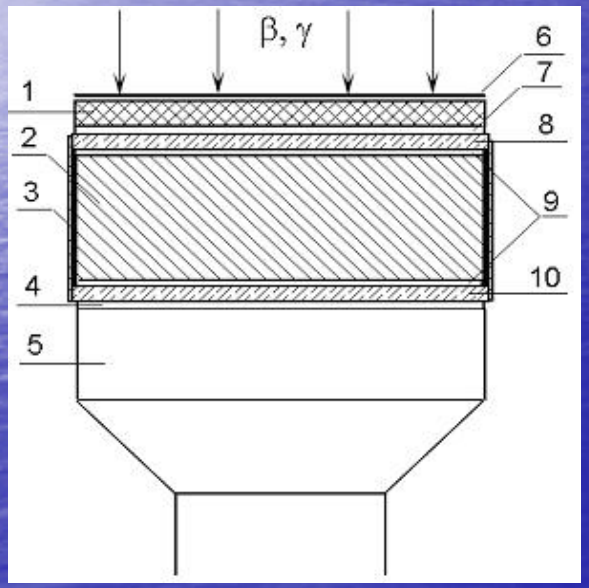
KDP and DKDP are the only materials suitable for fabrication of doublers and triplers of laser radiation frequency and Pockels cells, the laser strength of which is over 40 J/cm^2 (at λ=1.06 μm, τ=3 ns).
A unique industrial technology of the 8-12 mm/day rapid growth of large KDP single crystals (~ 60,0 cm) with the laser damage threshold of ~50 J/cm^2 for usage in mega joule lasers.

Growth technology

- *Institute for Scintillation Materials, Kharkov:*

1. Microwave assisted organic synthesis of heterocyclic compounds
2. Chiral components for twisted nematic liquid crystals
3. Development of basic physics for production technology of new scintillation materials – thin layers on substrates and combined detectors on their base for radionuclide monitoring of environment

Elaboration of high-resolution luminescence screens for X-ray imaging and new-type detectors for the simultaneous registration of the α-, β- and γ-particles separated by path length and decay time. Such portable detectors are perspective for radiation monitoring of environment, for detecting mixed radiation fluxes near nuclear objects, for exploring α-, β- decay simultaneously with other nuclear reactions.



Left: Scheme of scintillation block based on phoswich detector: 1, 2 – different scintillation layers, 5 – photoreceiver. Right: General view of the corresponding scintillation module (portable version).

Growth technology

- *Institute of Semiconductor Physics, Kiev:*

1. Nanocrystalline silicon (nc-Si) films obtained by pulsed laser deposition
2. Development of efficient methods for nanostructure formation based on II-VI wide band-gap semiconductors

Growth technology

- *Donetsk Physics & Technology Institute:*

1. Oxide multi-component nanosize particles, ceramics and composites for functional application

Fabrication technology

- *Institute of Semiconductor Physics, Kiev:*

1. Method of semiconductor substrate treatment without obtaining any deformation and surface defects
2. Optimization of $Cd_xHg_{1-x}Te$ semiconductor parameters by pulsed laser irradiation and device structures formation for infrared photoelectronics
3. Laser-induced doping and formation of electrical barriers in CdTe crystals for manufacturing X- and gamma-rays detectors

Institute of Semiconductor Physics, Kiev:

4. Transformation of the defect system in semiconductors with shock waves induced by nanosecond laser pulses
5. Processes of formation and self-organisation of nanostructures in II-VI and III-V crystals and films under pulse laser irradiation
6. Advanced materials for metallization of semiconductor devices
7. Application of chemical transport reactions in semiconductor technology for metallization of diamond and production of high efficient diamond tools

Institute of Semiconductor Physics, Kiev:

9. Unglued bonding technology for glass ceramic materials with zero thermal expansion coefficient
10. Development of fabrication methods of InAs diffusion photodiodes

Fabrication technology

- *Institute of Physics, Kiev:*

1. Development of low temperature photo-alignment process for plastic LCDs and other liquid crystal devices
2. Inorganic nanolithography with holographic elements for enhancement of optic and infrared signals
3. Creation of highly sensitive reverse registering mediums for optical holography based on polymer semiconductors
4. Effects of laser induced plasma in machining of transparent materials
5. Development of magnetron technology and manufacturing of vacuum line for deposition of decorative and selective coatings onto architecture glass

Fabrication technology

- *Institute for Low Temperature Physics and Engineering, Kharkov:*

1. Magnetic recording by formation of local current vortices in superconductors

B.Verkin Institute for Low Temperature Physics & Engineering, National Academy of Sciences of Ukraine

1. *Electron phenomena in conducting and superconducting media*
2. *Physics of quantum liquid, quantum crystals and cryocrystals*
3. *Low temperature magnetism*
4. *Mathematical Physics*
5. *Geometry and Topology*
6. *Low temperature material science*
7. *Devices and apparatus for low temperatures*

Devices and Equipment

- *Institute of Radiophysics and Electronics, Kharkov:*

1. Noncontact system for measuring temperature gradient on internal layers of objects
2. Millimeter-wave device for standard measurement of HTS film surface resistance
3. Analysis of evaporation and coating deposition methods by Double-Beam Multi-Capsule Electron Evaporator for high-vacuum film technologies

Devices and Equipment

- *Institute for Scintillation Materials, Kharkov:*

1. Novel UV-detectors based on isovalently doped zinc selenide for photo-biological safety systems
2. Promising oxide scintillators (OXS) and elements on their base for radiation instruments

Promising oxide scintillators (OXS) and elements on their base for radiation instruments

Application fields:

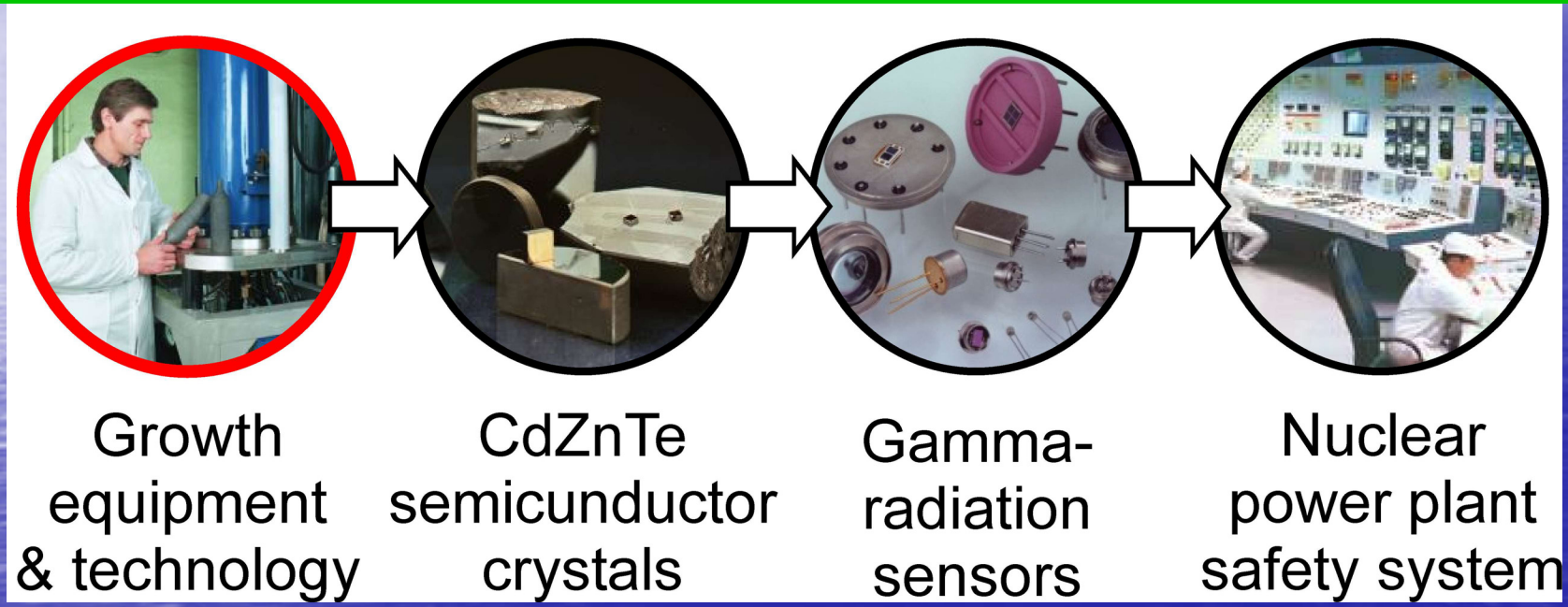
- anti-terrorist inspection, X-ray introscopy and tomography
- detection of illegal transportation of radioactive substances (including neutron)
- nuclear spectrometry
- radiation monitoring

Devices and Equipment

- *Institute for Single Crystals, Kharkov:*

1. Development of equipment and technology for growth of CdZnTe crystals for fabrication gamma-radiation sensors

The development of equipment and technology to obtain CdZnTe crystals for fabrication of gamma-radiation sensors



Aimed at new growth furnace construction and related technology process. High-quality CdZnTe crystals obtained will be used in compact, uncooled gamma-sensors for industrial, medical and scientific needs.

Devices and Equipment

- *Institute of Semiconductor Physics, Kiev:*

1. Development of technology and intelligent analytical complex for digital detection of odours
2. Radioluminescent indicating devices emitting in visible or near-infrared region
3. Development of acoustic universal adaptive module complex for multifunctional applications
4. Method of production of SiC-based complex optical mirrors

Devices and Equipment

- *Institute of Physics, Kiev:*

1. Chemical sensors based on porous semiconductor heterojunctions for determination of composition of liquid and gaseous mixtures

Characterization technique

- *Institute of Semiconductor Physics, Kiev:*

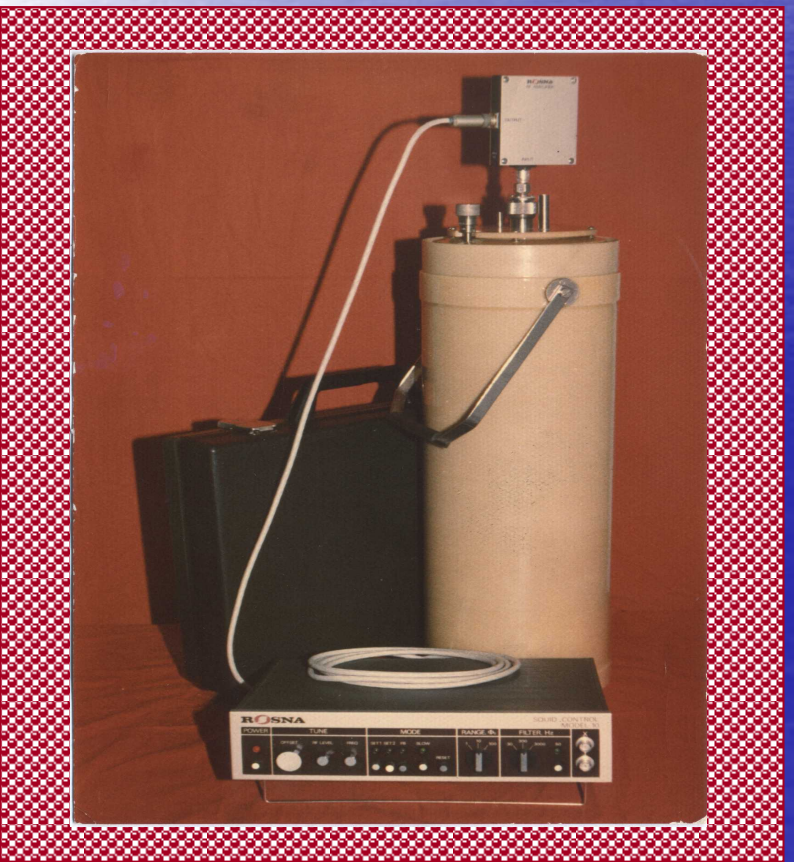
1. Development of the method for speckle-interferometric measurements of quasi-static shifts and vibration parameters of high porous and other materials
2. Design of portable optical instruments for express-diagnostics of viral cattle deseases

Characterization technique

- *Institute for Low Temperature Physics and Engineering, Kharkov:*

1. SQUID-based system for non-destructive evaluation of the construction materials in power engineering
2. Creation of complex equipment for investigation of radiation stability of materials (CE RSM)

Development and research on SQIUD – based system for nondestructive evaluation of the construction materials in power engineering



Prototype of portable high-Tc (HTS) SQUID-magnetometer was designed and is used for fatigue degradation detecting of stainless steel samples in cooperation with Korean Atomic Energy Research Institute (KAERI).

Features:

Liquid nitrogen cooling of sensor

Magnetic field sensitivity $\approx 5 \cdot 10^{-13}$ *T/Hz*$^{1/2}$

Magnetic moment sensitivity $\approx 5 \cdot 10^{-10}$ *A·m*^{2}

Low weight

Low cost

Easy to handle

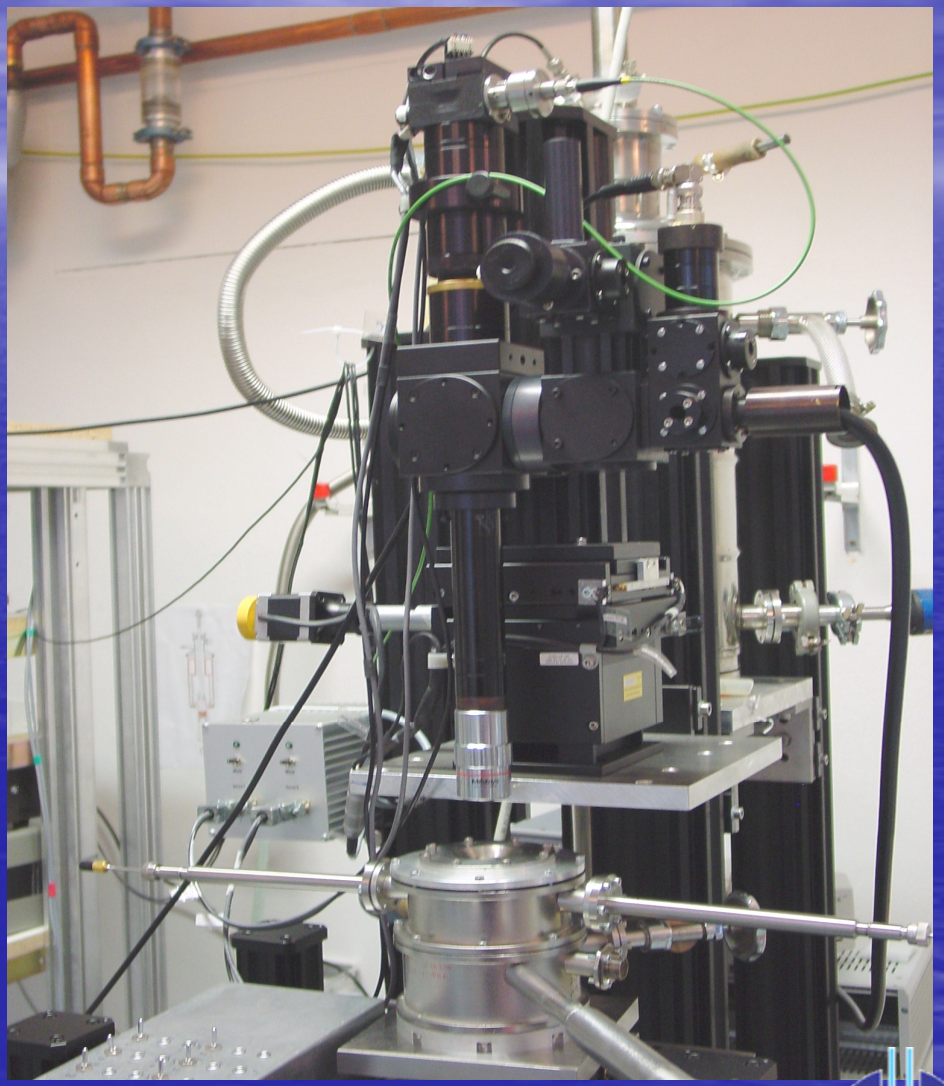
Low Temperature Laser Scanning Microscope

Technical characteristics:

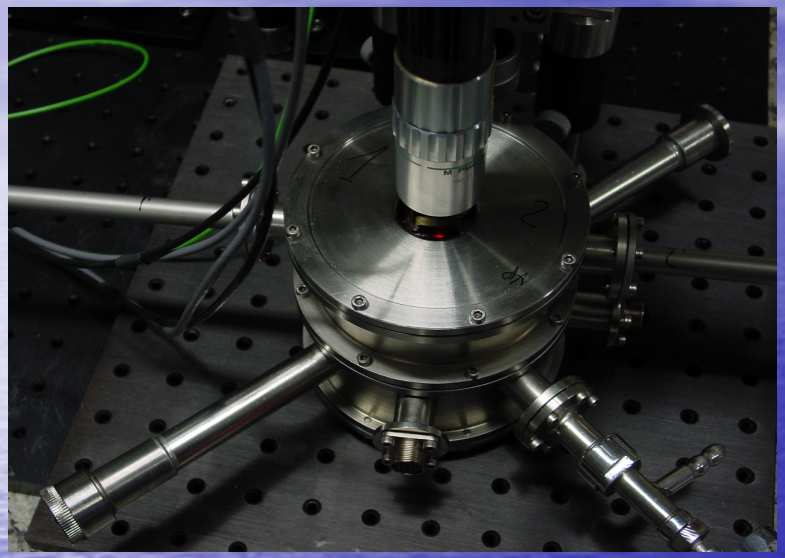
- Temperature range: 4.2 – 300 K;
- Spatial resolution: 0.3 mm;
- Scanned area: 50mm x 50mm;
- Sample dimensions: up to 50 mm;
- Spectral range: UV, VIS, IR.

Application fields:

- Reflected Light and Laser Scanning Microscopy
- UV, VIS, IR and Raman Spectroscopy
- Material Science and Solid-State Physics
- Failure and defect analysis in superconducting films and planar DC/rf devices



Optical cryostats for low-temperature micro- and spectroscopy



Characterization technique

- *Institute for Single Crystals, Kharkov:*

1. Elaboration of the method for determination of total content for soluble and suspended substances in natural and drinking water

Ice ingot with opaque part

The method based on measuring the length of the opaque part of the ice ingot (Fig. 1), obtained by means of low-temperature directed crystallization (LTDC).

The proposed method is extremely simple, easily automated and fast in comparison with other methods. It secures determination of TCS within 2-3 hours in a wide range – from 0,05 up to 4,00 g/L – using only 50 mL of water sample.

It is not necessary to provide any preliminary sample preparation (preserving, heat or chemical treatment) before carrying out LTDC.

The existing pilot unit has simple design and can be easily upgraded.

Characterization technique

- *Institute of Physics, Kiev:*

1. Development of new technique for detection of a minute amounts of Iodine-129 in natural specimen of gaseous Iodine

Thank you
very much
for your attention