Joint Institute for Nuclear Research

Frank Laboratory of Neutron Physics

Department of Neutron Investigations of Condensed Matter

LABORATORY EQUIPMENT

DUBNA

2021

DNICM presents the updated version of Booklet «LABORATORY EQUIPMENT»

Welcome to prepare samples for neutron experiments and to investigate your samples with complementary methods.

Contact the responsible persons to get detailed information about the equipment you are interested in and find out how to access it.

compiler of the booklet
Yu.E. Gorshkova

Building 42-A, 2nd floor, Room 22

Biochemical Laboratory Equipment

You are welcome for sample preparation and investigation of the soft matter objects

Responsible:
Tatiana Murugova

c o n t a c t s
tel.: +7 (496) 21-62-335
e-mail: murugova@jinr.ru

Building 42-A, 2nd floor, Room 22

Density meter
DMA 5000

Features

The Aton Paar DMA 5000 density meter is designed to measure the density of liquids and gases in wide temperature range.

Specifications

Measuring range:	Density 0 g/cm^3 to 3 g/cm^3
Sound velocity	1000 m/s to 2000 m/s
Temperature	0 °C to 70 °C (32 °F to 158 °F)
Pressure	0 bar to 3 bar (0 psi to 44 psi)
Repeatability s.d.	
Density	0.000001 g/cm³
Temperature	0.001 °C (0.002 °F)

Future information and theory
https://www.anton-paar.com/corp-en/products/details/dmatm-5000-m-density-meter/

Local contact: Oleksandr Ivankov Ivankov@jinr.ru

pH- and Ion- meter

Features

pH-meters is designed to measure the pH and the temperature of the sample. The glass electrode, which measures the hydrogen-ion activity of a sample, consists of an internal sealed tube containing a standard solution and silver – silver chloride half-cell. A pH-sensitive glass bulb forms the immersion end of this tube. The measurement is accomplished by determining the electrical potential that is developed across the glass membrane between the sample and the standard solution within the glass electrode.

Future information and theory
https://www.mt.com/de/en/home/products/Laboratory_Analytics_Browse/pH/benchtop_meter/SevenCompact/S220_pH-Ion.html

Local contact: Tatiana Murugova murugova@jinr.ru

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Chromatography System

NGC Quest™ 10 Plus

Features

instrument has automated 10 ml/min pumps that provide accurate gradients for high-resolution separations for any application. The NGC Quest 10 Plus system has a multi-wavelength detector with simultaneous four-wavelength monitoring for high-accuracy detection of proteins, peptides, and nucleic acids combined with conductivity measurements. Fractionated samples can be easily collected from analytical- to preparative-scale purifications using the NGC Fraction Collector

Specifications

- NGC two-tier base frame
- NGC F10 pump modules for a flow rate of 0.001–10 ml/min at 3,650 psi (252 bar, 25.2 MPa)
- NGC mixer module small (263 µl), includes an extension mixer barrel (750 µl)
- NGC multi-wavelength detector module for simultaneous four-wavelength detection at 190–800 nm and salt gradient monitoring with integrated conductivity monitor, includes tubing and fittings and one 5 mm flow cell
- NGC sample inject valve (sample inject valve kit) for automated application of small sample volumes from sample loops
- integrated system touch screen
- ChromLab™ software for instrument control, data collection, and data analysis
- documentation CD containing manuals for use with NGC systems

Future information and theory
https://www.selectscience.net/products/ngc-quest-10-plus-chromatography-system/?prodID=195557#tab-2

Local contact:
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Building 42-A, 2nd floor, Room 22

Stereo microscope

Local contact:
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Features

The TOP-CLASS STEREO ZOOM RESEARCH MICROSCOPE is equipped with polarizing attachment, photo equipment , different stages, mounting adapters for system integration, different stands, illumination ring for inspection of electrical parts.

Eppendorf termomixer

Local contact:
Tatiana Murugova
murugova@jinr.ru

Features

EPPENDORF TERMOMIXER COMPACT
The Termomixer compact is designed for incubating and mixing aqueous solutions in sealed micro test tubes. Temperature between 4˚C above room temperature and 99˚C can be maintained exactly and constantly. Mixing frequencies can be set between 300 rpm and 1400 revolutions per minute (rpm).

Eppendorf centrifuge

Local contact:
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murugova@jinr.ru

Features

The Centrifuge 5415 C is designed for centrifugation of 12 Eppendorf Micro Test Tubes simultaneously in a 45 degree fixed-angle rotor at 14,000 rpm

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NanoPhotometer

Features

Implen GmbH has developed the NanoPhotometer P360 to analyze ultra low sample volumes of 0.3µl while maintaining high accuracy, reproducibility and speed.

Small volume and cuvette capability always standard; Standalone mobile design with large LCD display and available thermal printer for convenient direct printing; Electronic data can be automatically generated in a variety of file formats when connected to a PC. 3.5 seconds per reading.

Future information

https://www.intas-shop.com/de/implen-nanophotometer-p-class-360.html

Local contact: Tatiana Murugova murugova@jinr.ru

Centrifuges

Features

Thermo Scientific SL 16 Centrifuge

temperature: -10-40°C
max speed: 15200 rpm
run time: 9 hr. 99 min. plus HOLD
various number of rotors

Heraeus Biofuge15R

temperature: 4-45°C
max speed: 15000 rpm
run time: 1-99 min

Future information

https://assets.thermofisher.com/TFS-Assets/LED/manuals/D21713~.pdf

Local contact: Tatiana Murugova murugova@jinr.ru

SONICATOR Q125, Qsonica

Local contact:
Tatiana Murugova
murugova@jinr.ru

Features

PROGRAMMABLE OPERATION
PULSE MODE
DIGITAL AMPLITUDE / INTENSITY CONTROL
Output intensity can be set from 20-100%
DISPLAY OF WATTAGE AND JOULES
Real-time energy monitoring

Power Rating	125 Watts
Frequency	20 kHz
Programmable Timer	10 Hours
Adjustable Pulse On/Off	1 Second to 1 Minute

Future information
https://www.sonicator.com/collections/sonicators/products/q125-sonicator

Trans-Blot Turbo Transfer System

Local contact:
Tatiana Murugova
murugova@jinr.ru

Features

- Western blotting
- Separation, transfer and analysis
- Protein blot transfers
- Evaluation of protein expression levels
- Immunological or biochemical analyses
- Protein-protein or protein-ligand interactions

Future information
https://www.bio-rad.com/ru-ru/product/trans-blot-turbo-transfer-system?ID=LGOQBW15

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Spin Coater

Features

Spin coating is a widely used and versatile technique for depositing materials onto substrates with accurate and controllable film thicknesses.

Specifications

User Profiles	10
Programs	10 programs on each user profile, with up to 50 steps each
Speed stability	<2% error
Speed	120 to 6000 RPM
Spin time	1 - 1000 sec
Power supply	DC 24V 2A, via 100-240v 50/60Hz power adapter
Safety Switch	Magnetic safety switch on the door
Dimensions	225 x 170 x 132 mm
Materials	Polypropylene bowl, steel casing, tempered glass lid

Future information

https://www.ossila.com/products/spin-coater

Local contact: Timur V. Tropin ttv@jinr.ru

UV-Ozone Cleaner

Features

The PSD and PSDP remove organic contaminates
UV lamp generates UV light at both 185nm and 254nm
Produces O3 and provides molecular excitation
Operates at atmospheric pressure with ambient air or oxygen
Multiple gas ports for the introduction of gases
Sample Stage with Adjustable sample to lamp distance
Safety switched to prevent user exposure to UV light

Future information

http://www.novascan.com/products/psd_uv_details.php

Local contact: Timur V. Tropin ttv@jinr.ru

OTHER EQUIPMENT

Ultrapure water system MiliQ

Refrigerators

2 standard refrigerators with temperature -20 ˚C and + 4˚C

Ultra-low temperature freezer -86 °C

Termobox

Incubators

2 incubators with temperature range from 5 ˚C to 60 ˚C

Branson ultrasonic bath

Balances

Bioblock Scientific Vacuum ovens

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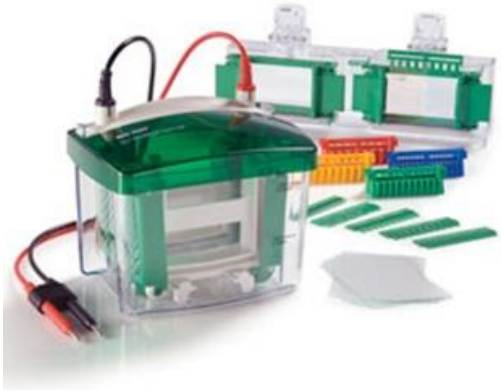
OTHER EQUIPMENT



Vertical Electrophoresis Cell

3D mini-shaker

Orbital shaker

Autoclave

Sterilizes at 121 °C
Capacity 9 L

Local contact:
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murugova@jinr.ru

Building 42-A, 1st floor, Room 11

Electrochemical Laboratory Equipment

You are welcome for XRD investigation of functional nanostructured materials

contacts
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Responsible:
Ivan Bobrikov

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X-ray Diffractometer EMPYREAN (PANalytical)

Features

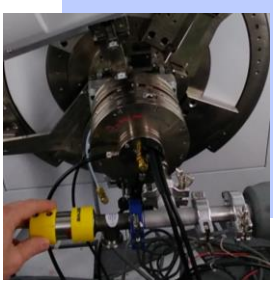
- Analysis of phase composition and type of crystal structure and microstructural parameters of pollycrystalline materials (films, nanomaterials and solid objects).
- Analysis of structural phase transition in a wide temperature range from 15 to 1200 K.
- Fast measurements and high reproducibility of results.
- Simple procedure of sample preparation, small sample volume.

Specifications

Working parameters	power supply ~ 40 kV, current ~ 40 mA
Feature	It has a vertical goniometer with 240 mm radius
Step size	~ 0.0001°
Scattering angle	1°< 2θ <168°
Signal processing	Auto- and cross-correlation operation modes. Linear and logarithmic scale.
Detector	PIXcel3D
Wave length	Co radiation (~ 1.789 Å)
Sample environment	Low temperature cryostat “Phenix“ (15 – 300 K) High temperature chamber Anton-Paar RT-1300 K (Air, Inert gas, Vacuum)

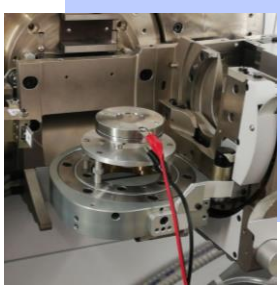
OXFORD PHENIX

T = 15 – 320 K



ANTON PAAR HTK1200N

T = RT - 1200 °C



3-AXIS STAGE

-reflectometry
-texture analysis
-non-standard samples

Future information and theory

https://www.malvernpanalytical.com

Local contact:
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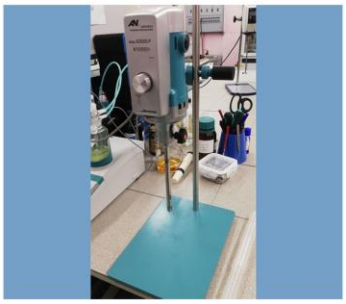
OTHER EQUIPMENT

Local contacts: Sergey Sumnikov (sumnikovsv@gmail.com)
Ivan Bobrikov (bobrikov@nf.jinr.ru)

MIXERS

OVERHEAD STIRRER HS-30D-SET (DAIHAN)

-maximal 10 liter
-speed 200 - 3 000 rpm
-maximal viscosity 10 000 mPas
-direct driven motor



UNI-WT AD500S-P HOMOGENIZER DISPERSER

-Speed range: 5000~28000 rpm
-Mixing processing viscosity (mPas): 5000
-Mixing capacity (H2O) (ml): 30-5000

VACUUM MIXER GN-VM-7

-Vacuum Level: 0.08~0.09 Mpa
-Rotary Speed: 320 rpm
-Available volume: 30-200 ml

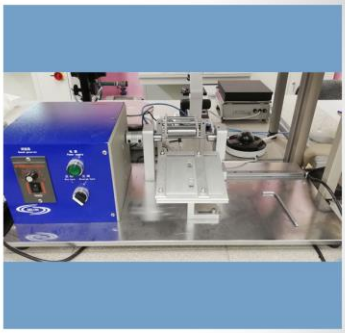
COATING AND ROLLING MACHINES

VACUUM COATING MACHINE WITH COVER HEATER

-Scrapper adjust range: 20 micron - 3mm
-Max. Heating Temp.: 200°C

LI-ION BATTERY ROLLING PRESSING HEATING MACHINE

-Electrode thickness: 15-200micron
-Max. Heating Temp.: 200°C
-Pressing force: 5-10 Ton



WINDING MACHINE FOR CYLINDRICAL CELL

-Dimensions: 4mm(OD) x 65mm(L)

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OTHER EQUIPMENT

DRYING OVEN AND FURNACE

DZF-6050 VACUUM DRYING OVEN

-Temperature range: RT+10-250°C

-Internal sizes: 300*300*270 mm

GASES

HIGH TEMPERATURE TUBE GAS FURNACE

-Temperature range RT-1200°C

-Gas: Argon, Helium, Oxygen

-Top opened

ELECTROCHEMICAL EQUIPMENT

AUTOMATIC COIN CELL CRIMPER AND DISASSEMBLING TOOL

BATTERY TESTERS

Number of channels: 10

Min current: 10mA

Max current: 6A

Maximum voltage: 5V

PROFESSIONAL POTENTIOSTATS: BIOLOGIC, ELINS

Min current: 10pA

Max current: 15A

Maximum voltage: 10V

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OTHER EQUIPMENT

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ELECTROCHEMICAL EQUIPMENT

METROHM 917 KARL FISCHER COULOMETER TITRATOR FOR WATER DETERMINATION

-Liquid, solids.
-Determining water contents above 0.1% and as a coulometric system for low water contents down to 0.001%
-bromine index

H2O AND O2 FREE GLOVE BOX

-stainless steel box, acid-resisting
-Argon atmosphere
-water and oxygen control <1 ppm
-2 chambers
-large internal space 750mm X 900mm

PRESSES, MILL AND POLISH MACHINE

PRESS MACHINES

-up to 10 Tons
-press forms for tablets

PLANETARY-TYPE BALL MILL

-Rotation speed: up to 900 rpm
-Jar types: ZrO2, agate, PTFE
-Jar volumes: 2*50 and 2*100 ml

POLISH MACHINE DP-U2 FOR SURFACE PREPARATION

-Rotation speed: up to 1500 rpm

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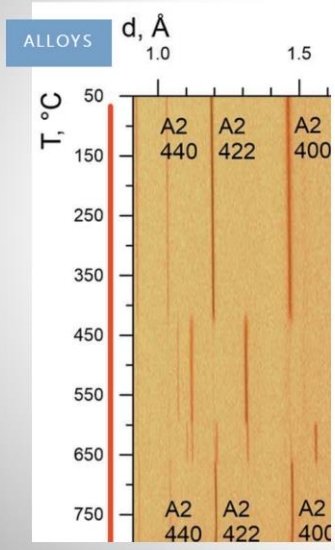
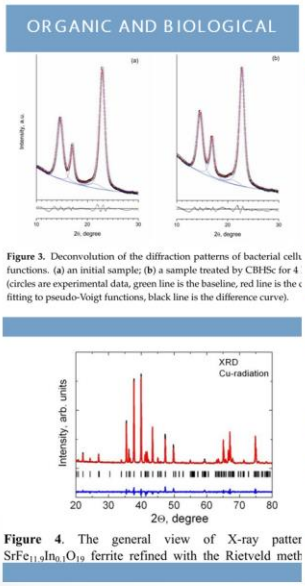
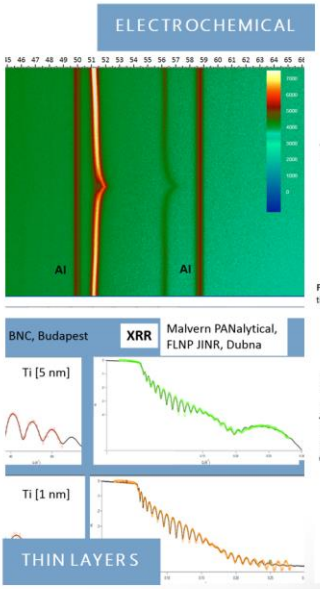
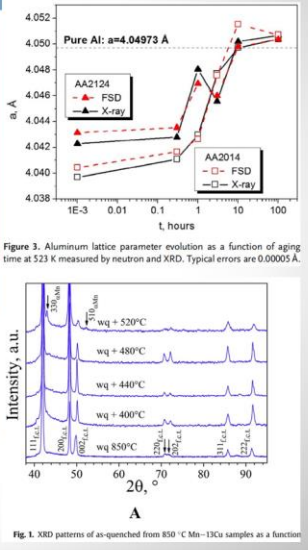
X-RAY PANALYTICAL EMPYREAN APPLICATIONS









PUBLICATIONS

Liying Sun et al, Journal of Alloys and Compounds 853 (2021) 157061

Fernández, R. et al. Advanced Engineering Materials (2020) 1901355

I.A. Bobrikov et al. Journal of Applied Crystallography 53 (2020) 1343–1352

Ivanova, L.A. et al. Materials 13 (2020) 2087

V A Turchenko et al. Phys. Scr. 95 (2020) 044006

Rodica Vladoiu et al. Materials 13 (2020) 399

T Zelenyak et al. Materials Science and Engineering 498 (2019) 012012

Vitalii Turchenko et al. Journal of Magnetism and Magnetic Materials 477 (2019) 9–16

Vitalii Turchenko et al. Journal of Magnetism and Magnetic Materials 477 (2019) 42–48

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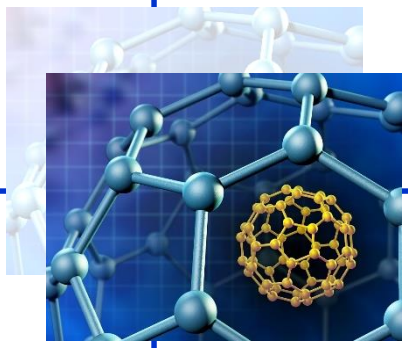

Laboratory Equipment

for investigation of soft matter

You are welcome for AFM investigation of biological objects, polymers and thin organic films, nanostructured materials,...

You are welcome to measure the particle size of dispersed systems and the stability of colloidal dispersions

Responsible: Yulia Gorshkova

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we use Google Calendar «JINR FLNP DCMRD BioLab»

Building 42-A, 1st floor, Room 15

AFM NTEGRA

Features

NTEGRA Prima is a multifunctional device for performing the most typical tasks in the field of Scanning Probe Microscopy.

Applications

Biology and Biotechnology
Proteins, DNA, viruses, bacteriums, tissues
Materials Science
Surface morphology
Polymers and Thin Organic Films
Spherulites and dendrites, polymer monocrystals, polymer nanoparticles, LB-films, thin organic films

Nanomaterials
Nanopowders, nanocomposites, nanoporous materials
Nanostructures
Fullerenes, nanotubes, nanofilaments, nanocapsules
Nanoelectronics
Quantum dots, nanowires, quantum structures

Specifications

Sample size	Up to 40 mm in diameter, up to 15 mm in height	
Sample weight	Up to 100 g	
XY sample positioning range, resolution	5x5 mm, 5 μm	
Positioning sensitivity	2 μm	
Scan range	100x100x10 μm	
Non linearity, XY (with closed loop sensors)	≤ 0.1%	
Noise level, Z (RMS in bandwidth 1000 Hz)	0.04 nm	
Noise level, XY (RMS in bandwidth 200 Hz)	With sensors Without sensors	0.2 nm (typically), ≤ 0.3 nm (XY 90 um) 0.02 nm (XY 100 um), 0.001 nm (XY 1 um)
Linear dimension estimation error (with sensors)	± 0.5% ± 1.2%	
Optical viewing system	Optical resolution Field of view Continuous zoom	3 μm 4.5-0.4 mm available
Vibration isolation	Active Passive	0.7-1000 Hz above 1 kHz

Future information and theory

https://www.ntmdt-si.com/products/modular-afm/ntegra-ii

Local contact:
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Particle size and zeta potential analyzer

Features

Photocor Compact-Z model are suitable for particle size and zeta potential measurements. Particle size measurements in opaque dispersions are available in back-scattering mode.
Fast measurements and high reproducibility of results.
Simple procedure of sample preparation, small sample volume. Using various square and cylindrical optical cells including flow-through cuvettes. High-sensitive APD photon counting system.
Different options are available that allows selecting the best instrument for your applications and budge.

Specifications

Measurement range	Particle size: 0.5 nm to 10 μm (diameter) Diffusion coefficient: 10^{-5} ... 10^{-10} cm^2/s
Accuracy	±1%
Sample volume	Particle size measurements: 50 μL to 4 mL (Zeta potential measurements: 1 mL to 3 mL)
Scattering angle	20°, 90°
Signal processing	Auto- and cross-correlation operation modes. Linear and logarithmic (multiple-tau) time scale. True real-time operation up to the fastest sample-time of 10 ns
Laser	TEC stabilized diode laser 638 nm, 25 mW [3]
Thermostat	Temperature range: 5°C - 90°C, accuracy 0.1°C (thermoelectric module)
Zeta potential	Analysis methods: Electrophoretic light scattering (ELS), Phase analysis light scattering (PALS)

Future information and theory

https://www.photocor.com

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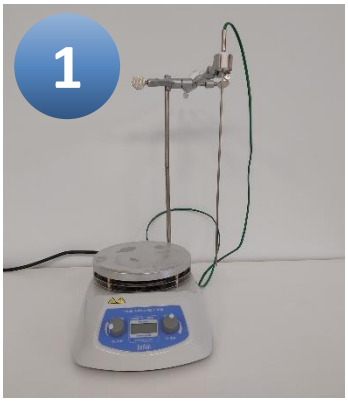
OTHER EQUIPMENT



1 - Intelli-Stirrer MSH-300i *(BioSan)*
2 - Ultrasonic bath 2.8 l, heating up to 70°C *(Sapphire)*
3 - pH-метр/иономер S220-Kit с электродом InLab Expert Pro-ISM *(Mettler Toledo)*
4 - Centrifuge/Vortex Multispin MSC-6000 *(BioSan)*
5 - Thermo-Shaker TS-100C *(BioSan)*
6 - INCUBATOR 2x23L Dig. COOLING TOWER *(Domel)*
7 - Laboratory refrigerator ХЛ-340 *(Pozis)*

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Building 42-A, 1st floor, Room 15

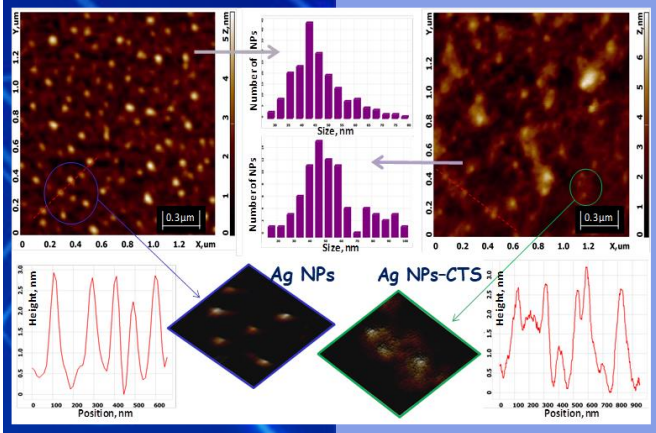
AFM APPLICATION

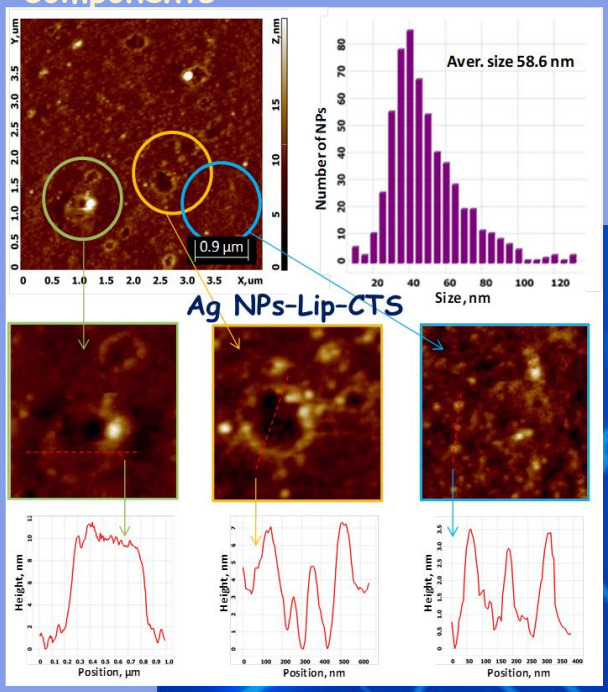
nanomaterials

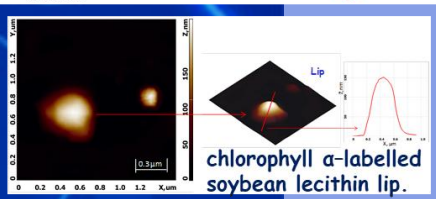
IF 4.324, Q1 (SRJ 0.86)

Biohybrid entities phyto-generated from nettle & grapes, with potential applications in biomedical field. Yu. Gorshkova, M. E. Barbinta-Patrascu *et al.* 2021. Nanomaterials.

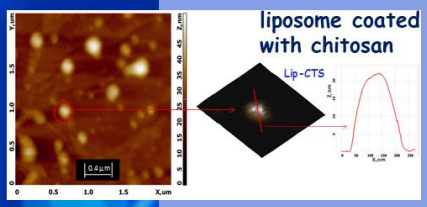
Morphology of biohybrid complexes and its components



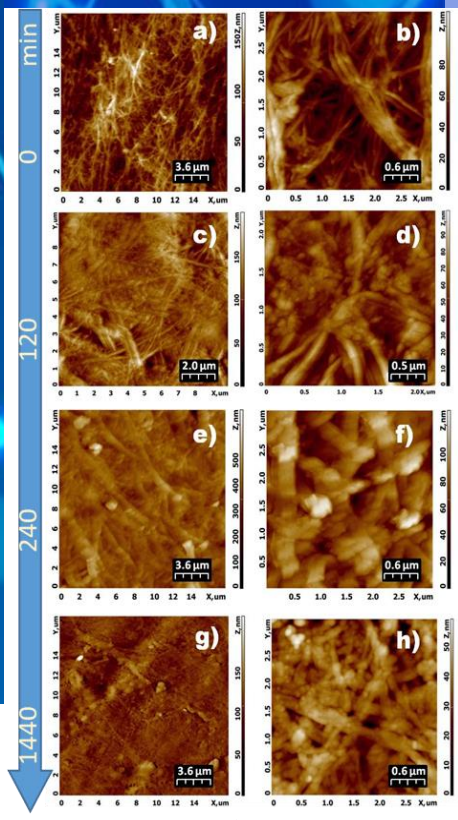




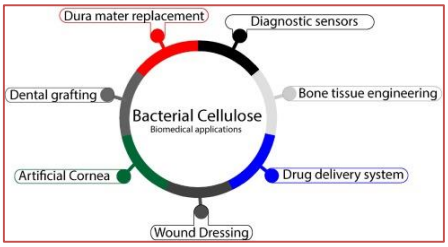
chlorophyll a–labelled soybean lecithin lip.



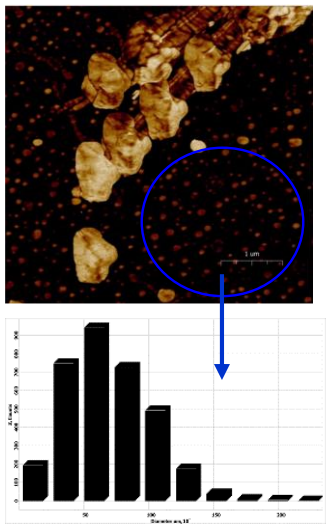
liposome coated with chitosan



Crystal and supramolecular structure of bacterial cellulose hydrolyzed by cellobiohydrolase from *Scytalidium candidum* 3C: A basis for development of biodegradable wound dressings. Lyubov A Ivanova *et al.*, Materials, **2020**, 13, 2087



"loosening" of the surface of native bacterial cellulose treated with CBHSc (*cellobiohydrolase from yeast-like fungus*)



AFM phase of C_{70}-BeCl and size distribution of the fullerene

Interaction between the plant alkaloid berberine and fullerene C70: Experimental and quantum-chemical study. O. Kyzyma *et al.*, J. Mol. Liq., 2019, 278, 452-459

AFM APPLICATION

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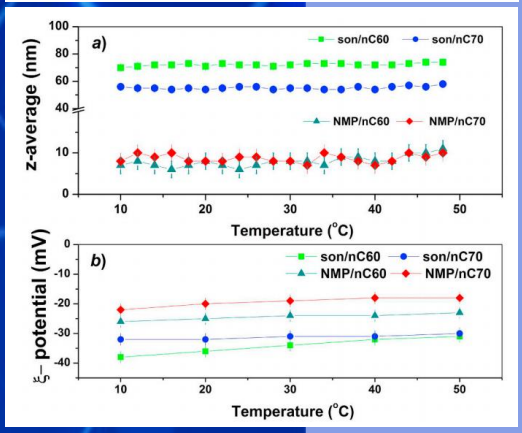
DLS APPLICATION

State of aggregation and toxicity of aqueous fullerene solutions. Kyzyma O.A. *et al.* (2019) Applied Surface Science 483 69–75



Structural reorganization of fullerene C70 in N-methyl-2-pyrrolidone/toluene mixtures. Nagorna T.V. *et al.* (2018) Journal of Molecular Liquids 272 948–952

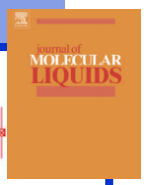
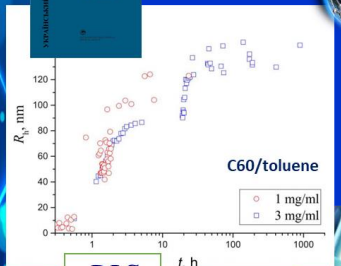
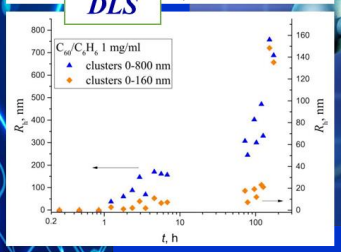


Fig. 2. The hydrodynamic size distribution by mass from DLS measurements obtained for C_{70}/NMP/toluene system with different volume fractions of toluene: ● – 0 vol% (initial solution C_{70}/NMP); ● – 20 vol%; ● – 40 vol%; ● – 60 vol%; ● – 70 vol%; ● – 80 vol%; ● – 90 vol%. Inset: an average size of the aggregates versus volume fraction of toluene. The dark section outlines an instrumental limits of SAXS to cover a size experimentally. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Investigations of the kinetics of cluster growth in fullerene C60 solutions. Tropin T.V. *et al.* (2020) Ukr. J. Phys., 65, 8



DLS

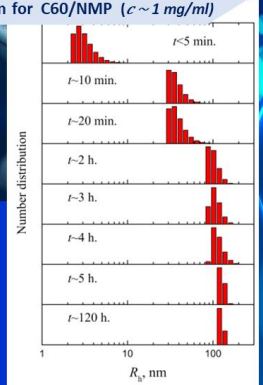


	Low-polar solvents (toluene, benzene, ...)	Polar solvents (pyridine, NMP , ...)
Molecular solution	Stable	Unstable
Cluster formation	Non equilibrium preparation conditions	Under any conditions
Cluster sizes	Up to several microns	Hundreds of nanometers
Formation time	Max. size : 7-12 days	1–2 h
Interaction with solvent	Formation of solvation shells	Complex formation with solvent molecules

- Aggregation starts only after the solution is subjected to light and a sufficient amount of air
- Two-step character of the growth
- The clusters grow within first few hours after the aggregation starts

«In low-polar liquids, the light and oxygen are required to initiate the formation of clusters, while the aggregation starts already at the dissolution stage in polar solvents.»

Evolution of the cluster-size distr. function for C60/NMP (*c* ~ *1 mg/ml*)



DLS APPLICATION

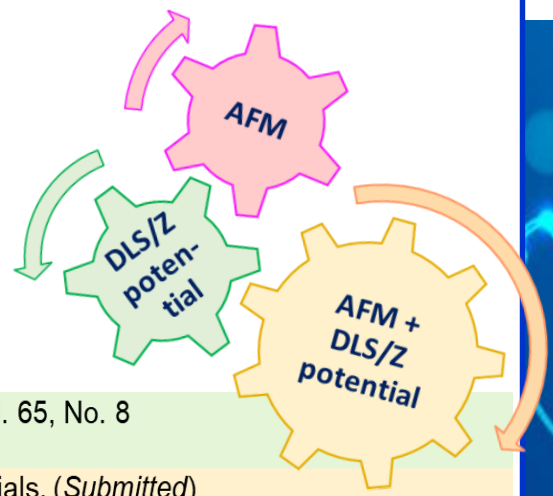
PUBLICATION ACTIVITY

4+ ...
2020

5
2019

2
2018

1
2017



1. Tropin T.V. *et al.* (**2020**) Ukr. J. Phys., Vol. 65, No. 8 DOI: 10.15407/ujpe65.8.701
2. Gorshkova Yu. *et al.* (**2020**) , Nanomaterials. (*Submitted*)
3. Barbinta-Patrascu M.E. *et al.* (**2020**) Journal of Nanomaterials. (*Submitted*)
4. Ivanova L. A. *et al.* (**2020**) Materials, 13, 2087 DOI: 10.3390/ma13092087
5. Kyzyma O.A. *et al.* (**2019**) Applied Surface Science, 483, pp. 69-75. DOI: 10.1016/j.apsusc.2019.03.167
6. Kyzyma O. *et al.* (**2019**) Journal of Molecular Liquids, 278, pp. 452-459. DOI: 10.1016/j.molliq.2019.01.062
7. Kichanov S.E. *et al.* (**2019**) Materials Chemistry and Physics, 237, № 121830. DOI: 10.1016/j.matchemphys.2019.121830
8. Lezov A.A. *et al.* (**2019**) Colloid and Polymer Science, 297 (2), pp. 285-296. DOI: 10.1007/s00396-018-4458-9
9. Nabiyev A. *et al.* (**2019**) Romanian Journal of Physics, 64 (5-6), № 603.
10. Nagorna T.V. *et al.* (**2018**) Journal of Molecular Liquids, 272, pp. 948-952. DOI: 10.1016/j.molliq.2018.10.110
11. Nagorna T.V. *et al.* (**2018**) Journal of Surface Investigation, 12 (5), pp. 872-876. DOI: 10.1134/S1027451018050063
12. Nagorna T.V. *et al.* (**2017**) Journal of Molecular Liquids, 235, pp. 111-114. DOI: 10.1016/j.molliq.2016.12.017

Building 120, 2nd floor, Room 211

Laboratory equipment

for synthesis and investigation of

new materials

Investigation of electronic, thermal dynamical and adsorption properties of new materials

Synthesis of new magnetic sorbents, organic materials and metal–organic frameworks

Responsible:
Andrzej Pawlukojc

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Shimadzu UV-Visible Spectrophotometer

Features

The compact Shimadzu
UV-Visible Spectrophotometer
UV-2600 is a universal, research –
grade spectrophotometer that can be used in a wide range of fields,
and easily expanded to suit the measurement objective.
Validation software is provided as standard for instrument.

Specifications

Spectral range	185-900 nm
Resolution	0.1 nm
Wavelength accuracy	± 0.3 nm
Photometric range	-5 to +5 Abs
Photometric accuracy	± 0.002 Abs (at 0.5 Abs); ± 0.003 Abs (at 1 Abs); ± 0.006 Abs (at 2 Abs); ± 0.3% T
Light source	50 W Halogen Lamp
Optical System	Double Beam, Single Monochromator
Spectral Bandwidth	0.1, 0.2, 0.5, 1.0, 2.0 or 5.0 nm

Future information and theory

http://www.shimadzu.com

https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/spectrpy/uv-vis/spectrum.htm

http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/001/304/UV-Vis_Student%20resource%20pack_ENGLISH.pdf

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Differential Scanning Calorimeter DSC 204 F1 Phoenix

Features

Differential scanning calorimetry is a method of thermal analysis in which the difference in the amount of heat required to increase the temperature of a sample and reference is measured as a function of temperature.

DSC allows to study phase transition during the heating and in low temperature.
High level of calorimetric sensitivity, good separation of overlapping thermal effects.
Proteus software on Windows includes determination of onset, peak, inflection and end temperatures. Automatic peak search.
Transformation enthalpies: analysis of peak areas (enthalpies) with selectable baseline and partial peak area analysis.

Specifications

Temperature range	-180 °C to 700 °C
Atmospheres	Nitrogen, argon, helium

Future information and theory

https://www.netzsch-thermal-analysis.com/en/products-solutions/differential-scanning-calorimetry/dsc-204-f1-phoenix/

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Thermogravimetry
TG 209 F1 Libra

Features

Thermogravimetric analysis is a method of thermal analysis in which the mass of a sample is measured over time as the temperature changes.

Fast and accurate thermogravimetric analysis over a wide temperature range.

Proteus software on Windows includes mass changes in % or mg, determination of the residual mass. Peak temperatures of the 1st and 2nd derivate of the mass changing curve.

Specifications

Temperature range	RT to 1000 °C at the sample
Wide measuring range	2000 mg
Sample crucible volume	up to 350 µl
Atmospheres	Nitrogen, argon, helium, air
Vacuum-tight assembly	up to 10^{-2} mbar (1 Pa)

Future information and theory

https://www.netzsch-thermal-analysis.com/en/products-solutions/thermogravimetric-analysis/tg-209-f1-libra/

Local contact:
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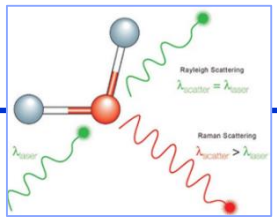
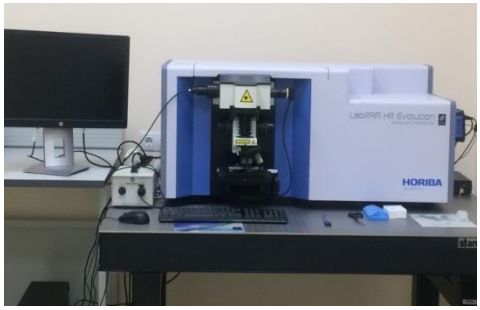
LabRAM HR Evolution
Raman Microscope



Features

Fully automated Raman microscope allows fast non-destructive chemical micro-analysis and automated high definition Raman chemical imaging. Raman microscope can be used in many varied applications, including characterization of graphene/CNT materials, pharmaceutics, geology, materials and life science

A method of analysis which is based upon the interaction of light with the chemical bonds within a material.



Specifications

Laser source	He-Ne 633 nm (red line) 9 mW
Resolution	1.5 cm^{-1}
Spectral range	50 – 4000 cm^{-1}
Temperature range	10 K - RT
Pressure range	0 - 30 GPa
Objectives	10x, 20x, 50x, 100x
Accesories	Motorized XY mapping stage
Samples	crystal, powder, liquid

Future information and theory

http://www.horiba.com/scientific/products/raman-spectroscopy/raman-spectrometers/raman-microscopes/hr-evolution/labram-hr-evolution-17309/

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Microwave Digestion System WX-6000

Features

The principle of operation of the microwave digestion system is based on the use of microwave energy to decomposition of diffrent kind of samples in sealed containers with additives of mixture of acids. The system is designed for the decomposition (mineralization) of food samples, soils, rocks, biological fluids, inorganic materials, etc. for further elemental analysis.
Temperature and pressure are monitored in real time.
Operator safety is guaranteed by robust autoclaves and reaction parameter control systems as well as a fully metal system housing.

Specifications

Number of simultaneously processed samples	up to 10
Reaction vessel volume	100 ml
Maximum weight	4 g
Working pressure	up to 40 atm.
Working temperature	up to 240°C.

Future information and theory

http://www.preekem.com/en/175

Local contact:
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Equipment for hydrothermal (Solvothermal) synthesis

- TEFIC reactors
- Berghof high-pressure reactor BR-100
- Carl Roth high-pressure reactor

The equipment is designed to carry out syntheses under controlled temperature (up to 250˚C) and pressure (up to 200 bar). The use of extreme conditions for synthesis makes it possible to carry out reactions that are poorly proceeding under normal conditions.

Future information

https://www.berghof-instruments.com/en/product/br-100-200/

https://www.carlroth.com/en/en/100-ml-high-pressure-laboratory-autoclave-model-i/high-pressure-laboratory-autoclaves-model-i-basic-equipment/p/2001.1

Local contact:
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Building 120, 2nd floor, Room 211

OTHER EQUIPMENT

Draying ovens
(up to 300°C)

Melting point apparatus (MP40, Stuart Scientific)

Rotary evaporator

Cooling incubator
(temperature range from 15˚C to 50˚C)

Ultrasonic homogenizer

Balances

Water Purification System RiOs-DI (Merck)

pH meter

Magnetic stirrers

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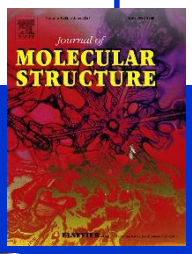
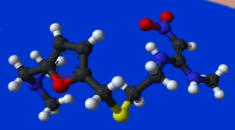
APPLICATIONS

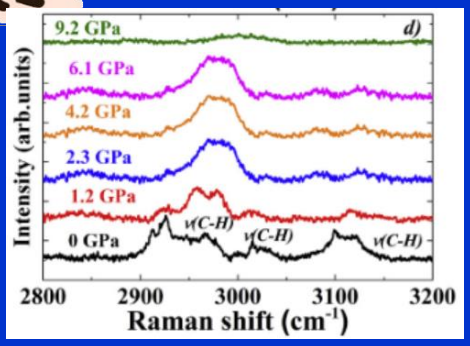


A high pressure effect on the vibrational spectra of ranitidine hydrochloride.

S.E. Kichanov et al. (2020) Journal of Molecular Structure, 1218, 128515 (IF 2.463, Q1)

Ranitidine hydrochloride is a drug, which inhibit the gastric acid secretion and used for peptic ulcer.

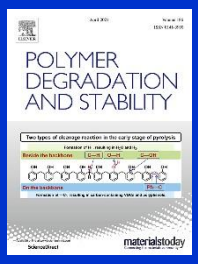


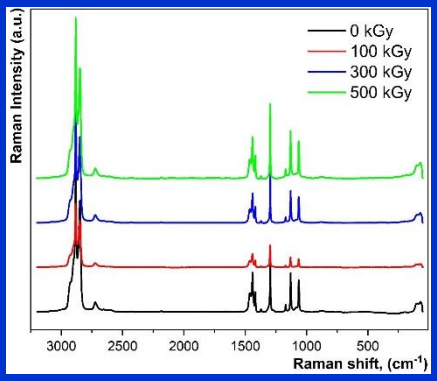


In order to search the pressure-induced polymorphic transitions and amorphization of ranitidine hydrochloride, Raman spectroscopy experiments were performed at pressures up to 11.2 GPa. At a pressure above 1.2 GPa a polymorphic phase transition from the initial form to a new pressure induced form has been observed. At pressures above 6.2 GPa, a gradual transformation to the amorphous phase of ranitidine hydrochloride has been revealed.

Nano-ZrO_2 filled high-density polyethylene composites: structure, thermal properties, and the influence γ-irradiation.

A.A. Nabiyev et al. (2020) Polymer Degradation and Stability, 171,109042 (IF 4.032, Q1)





Raman shift, cm^{-1}	Mode	Phase
1063	ν_{as} (C-C)	Crystalline, trans chains
1081	ν (C-C)	Amorphous
1130	ν_{s} (C-C)	Crystalline, trans chains
1170	ρ (CH_2)	Crystalline + amorphous
1295	τ (CH_2)	Crystalline
1310	τ (CH_2)	Amorphous
1370	ω (CH_2)	Crystalline + amorphous
1416	δ (CH_2)	Crystalline (Orthorhombic)
1438	δ (CH_2)	Crystalline (Orthorhombic)
1440	δ (CH_2)	Amorphous, trans-chains
1462	δ (CH_2)	Amorphous, melt-like phase
2847	ν_{s} (C-H)	Crystalline + amorphous
2881	ν_{as} (C-H)	Crystalline + amorphous

The development of polyethylene composites based on metal oxide fillers is important direction in the field of new radiation-resistant materials. The polymer nanocomposites were investigated using small-angle neutron scattering at the IBR-2, and scanning electron microscope, X-ray diffraction, infrared spectroscopy, Raman spectroscopy, DSC and TGA.

Building 44, 1st floor, Room 8

Laboratory equipment

for fundamental and applied research

with the use of

X-rays

January

2022

Proposed Commissioning for Users

Responsibles:
Yulia Gorshkova & Evgeny Lukin

contacts
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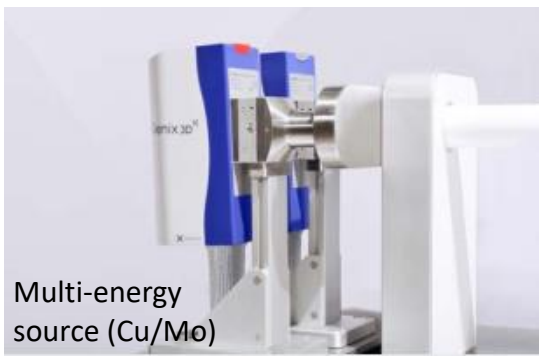
Building 44, 1st floor, Room 8

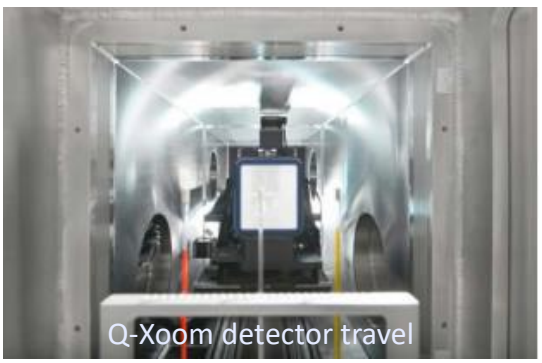
Xeuss 3.0

SAXS/WAXS/USAXS beamline


Multi-energy source (Cu/Mo)


Movable 4-axis WAXS detector


Sample holders


Q-Xoom detector travel

Future information: https://www.xenocs.com

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Evgeny Lukin (lukin@jinr.ru)