ITNMS

INSTITUTEFORTECHNOLOGYOFNUCLEAR
AND OTHERMINERAL RAW MATERIALS

CATALOGUE

Activities in Science, Technology and Engineering

QUALITY SYSTEM
JUS ISO 9001-QS1-0102
SRPS ISO 17025:2006-01-153

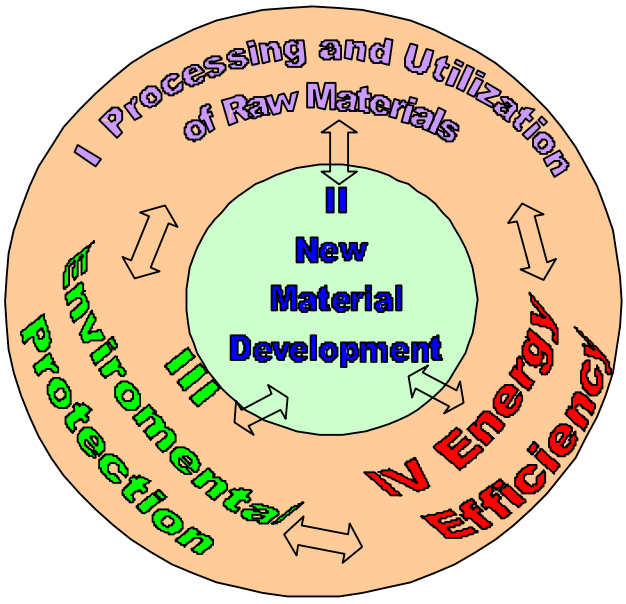
ITNMS

Institute for Technology of Nuclear and other Mineral Raw Materials

Activities in Science, Technology and Engineering

- **Scientific-technological activity is always in procedure: fundamental – applied – developing research, directed to obtain engineering solutions in the fields of:**
  - **processing – the use of scarce and poor mineral raw materials, as well as the main production (waste and secondary) materials, to obtain applicable raw materials;**
  - **development of new materials with deined quality for particular constructional or functional use;**
  - **environmental protection – monitoring of air, water and soil polution, the recyclling of waste and secondary raw materials, sewage and gass purifying and remediation of degraded or contaminated soils;**
  - **improvement the energy efficiency in technological processes.**

All the problems in scientific-technological activities are correlated in research:



Franše d'Eperea 86, 11000 Beograd, 390, . (011) 369-17-22, . (011) 369-15-83
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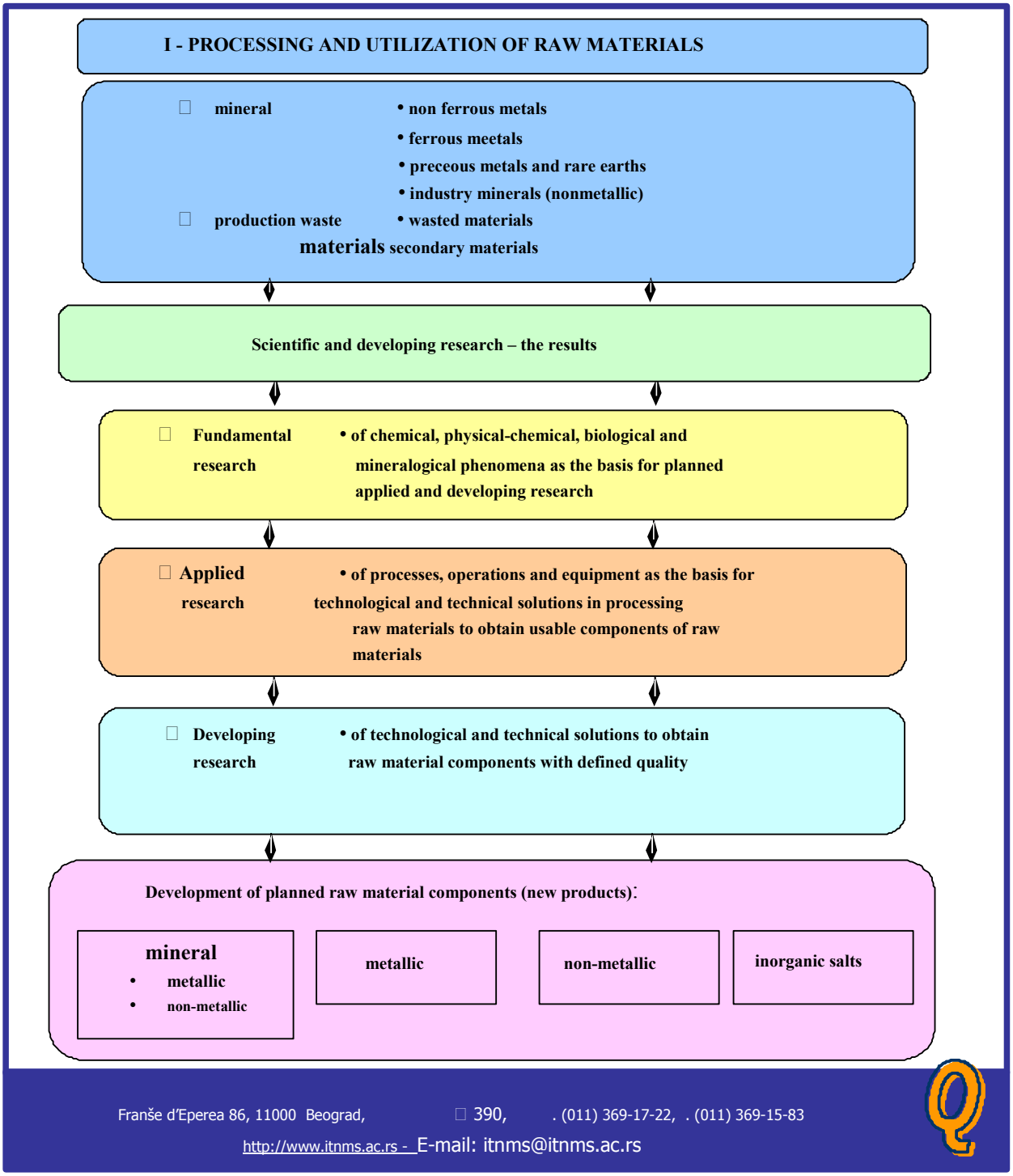
Planned results obtaining procedure in the field of processing/using the disposable mineral and production waste materials



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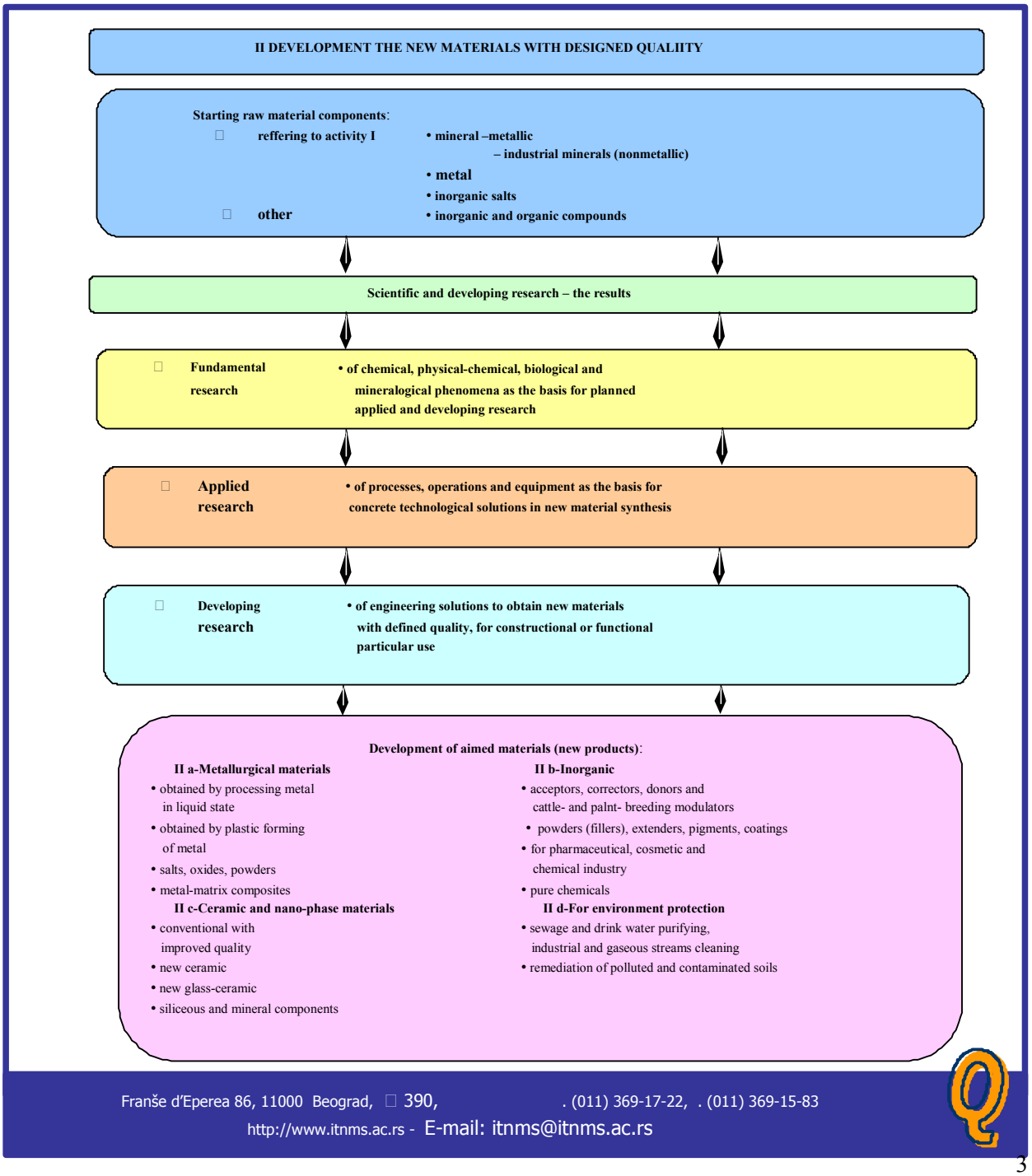
Planned results obtaining procedure in the field of synthesis the new materials with designed quality



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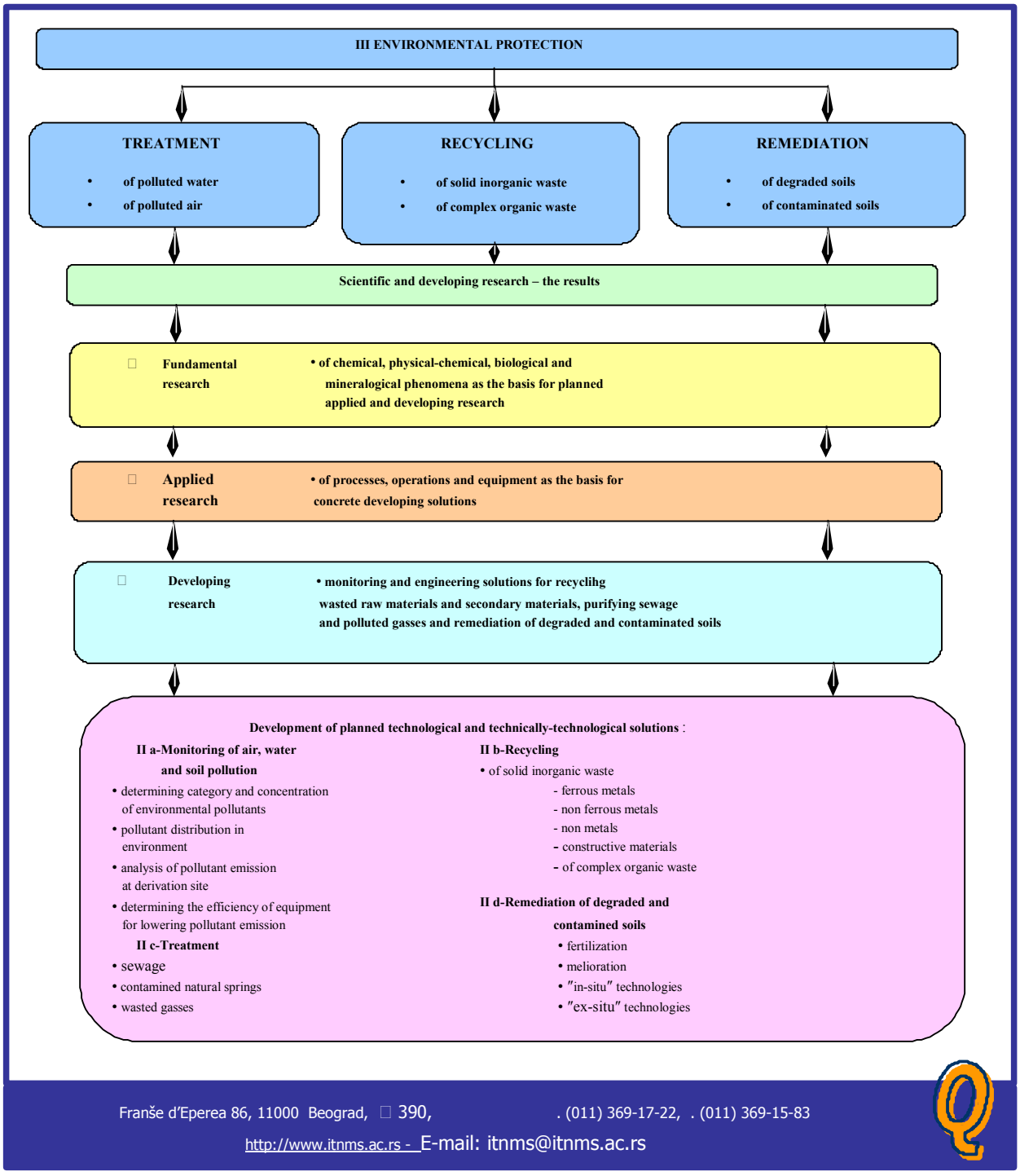
Planned results obtaining procedure in the field of environmental protection



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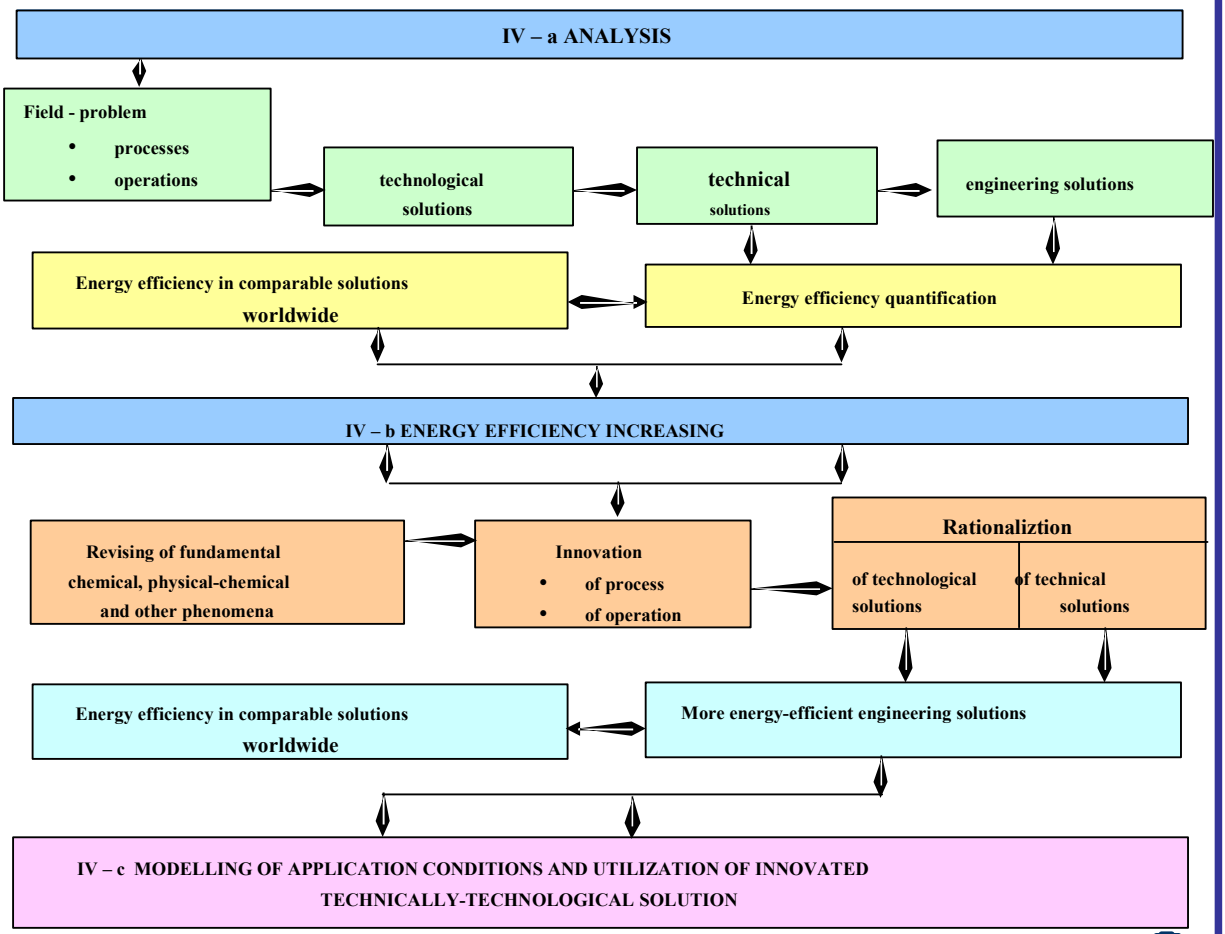
Planned results obtaining procedure in the field of energy efficiency

IV ENERGY EFFICIENCY

- **Energy efficiency,** as the worldwide trend in saving energy that is being scarce day by day. Research for technological and technically-technological problem solutions in the field of : processing – the use of available raw materials (I), new materials with defined quality development (II) and environment protection (III), which are - according to experience - great energy consumers.
- **Methodology**:



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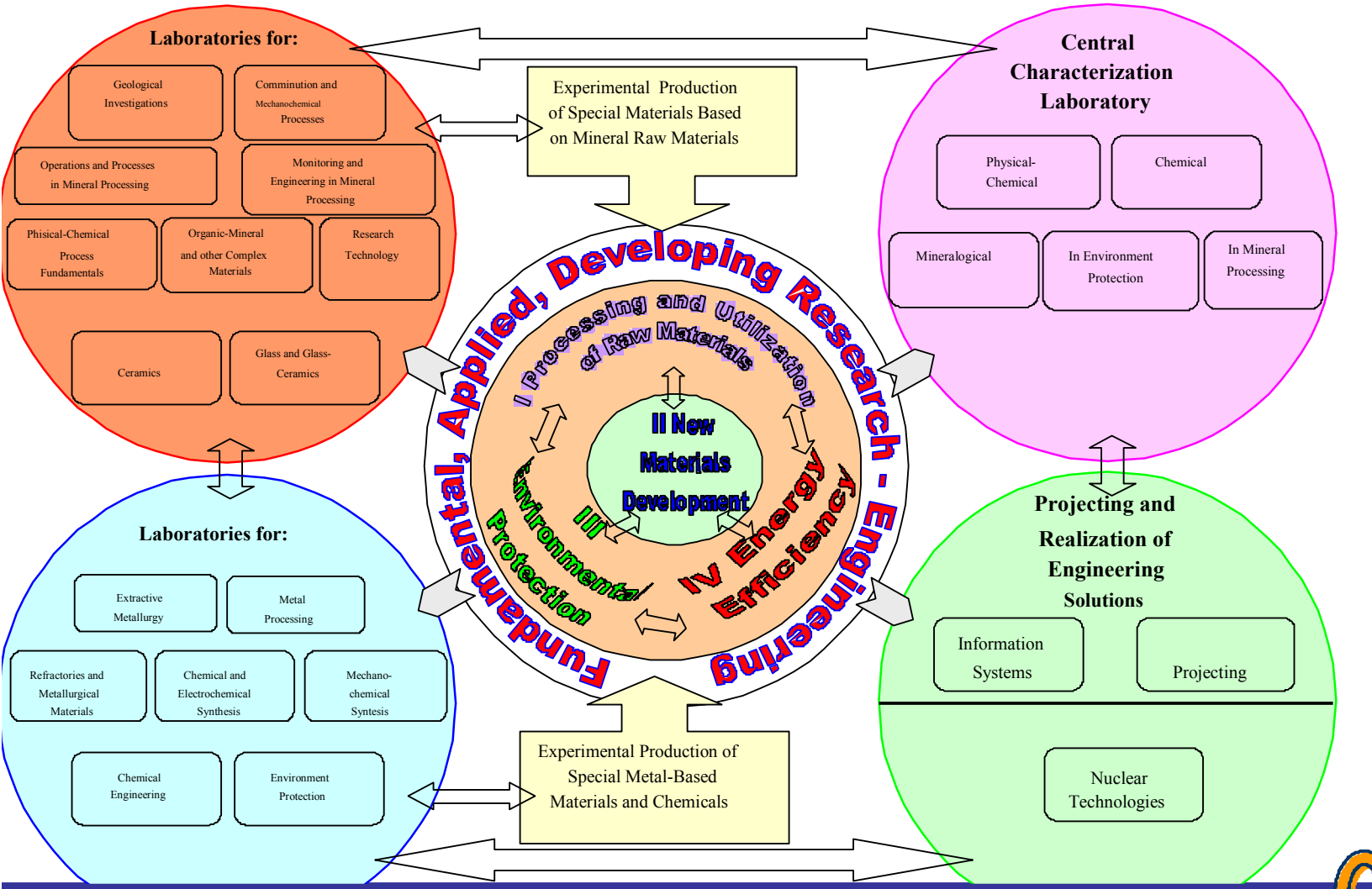

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Laboratory for Geological Investigations

FIELD:

Fundamental and detailed geological research of solid mineral raw materials according to:

- **Industrial mineral raw materials** (ceramic and brick-clays, quatrz sands, quartzites, silicates and aluminium-silicates, oxides and hydroxides, carbonates).
- **Agricultural mineral raw materials** (zelites, carbonates, phosphates, salts).
- **Ores** for: a) metals for ferrous metallurgy (iron, manganese, chromium, nickel, etc); b) metals for non-ferrous metallurgy (copper, lead, zinc, antimony, etc); c) light metals (aluminium, magnesium, silicon etc); d) rare metals (cobalt, rare earths, zircon, etc); e) precious metals (gold, silver, PGE); f) radioactive metals (uranium, thorium).

ANALYSIS:

- Geological terrain prospect and elaboration of geological map (plan).
- Geological mapping of surface examinational boreholes, mining cuts, insections, tiers.
- Geological mapping of examinational boreholes, rising mines, galleries, tiers, etc.
- Geological proving of examinational mining-geological works for laboratory analysis.
- Geological proving and making the composites for laboratory, semi-industrial and industrial technological examinations.

OTHER:

- Elaboration the Project for fundamental and detailed geological research, with acquisition the documentation for obtaining the examination licence from authority the Ministries of Serbia.
- Examination of mining raw materials with geological reserves estimation in the field of ferrous and non-ferrous metallurgy, including economic evaluation.
- Examination of industrial mineral raw materials with geological reserves estimation in the field of ceramic, refractory and other branches of nonmetals and constructive materials industry.
- Elaboration of fundamental and detailed geological reports.
- The revision of geological projects and reports, with revision certification.
- Elaboration the report on ore reserves with associated technical documentation and appointed certification by Ministry of Serbia.

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www itnms. ac.rs E-mail: v kasic@itnms.ac.rs

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LABORATORY FOR COMMINUTING AND MECHANOCHEMICAL PROCESSES

FIELD:

Fundamental, applied and developing research of comminution process to obtain ultra fine materials (nano-phase range), as well as mechanical and mechanochemical activation of both natural and synthetic materials:

- Kinetics and mechanical energy of grinding;
- Defining the quantity of mechanical energy, which is produced in mills, and proportion of energy converting to material;
- Basic characteristics of mills technical solutions and the mills variety influence on quantity and rate of mechanical energy transmission;
- Kinetics of mechanical energy conversion;
- Kinetics of mechanical and mechanochemical mineral activation;
- The converted mechanical energy influence on chemical and structural changes in material;
- Influence the structural defects energy in materials on mechanical and mechanochemical activity of reaction kinetics;
- Mechanical and mechanochemical material activation effect in different processes (synthesis, sintering, mechanofusion and so on);
- Technological and engineering solutions of fine grinding (micronizing) of mechanical and mechanochemical activation.

EXAMINATION AND APPLICATION:

Preparation and production

- of metallurgical materials and alloys;
- of artificial compost;
- of ceramic and constructive materials and pigments;
- of refractory materials;
- of glass and glass-ceramics;
- of plant protection substances and
- of dry powders for fire protection.

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs - E-mail: m.petrov@itnms.ac.rs

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LABORATORY FOR OPERATIONS AND PROCESSES IN MINERAL PROCESSING

FIELD:

Fundamental, applied and developing research of metallic, nonmetallic, energetic and secondary raw materials for the sake of:

- Optimal technological process of mineral processing selection;
- Calculation of processing economy and product utilization;
- Qualitative flow-sheet of technological process selection;
- Determining the parameters needed for equipment choice;
- Optimal parameters choosing considering sort, quality and value of obtained products;

EXAMINATION:

- **Samples preparation:** grinding, milling, comminution, sampling.
- **Characterization of raw material and concentration product:** physical characteristics, raw humidity, bulk density and specific weight, specific activity area, pH value, hardness, grinding index and grain sizing, chemical and mineralogical characterization. **Technological examinations of concentration:** comminution and classifying, atritional scrubbing, gravitational concentration, magnetic concentration, electrostatic concentration, flotation and leaching; elaboration the concentration balance-sheet and qualitative flow-sheet of technological process.
- **Technological examinations of drainage:** coagulation and filtration
- **Technological examinations of enlarging:** pelletizing and briquetting.
- **Semi-industrial technological examinations** are carried out according to flow-sheet and conditions determined in laboratory examinations, for the sake of checking out and confirming laboratory examination results.

OTHER:

- Running-in the industrial plants;
- Feasibility study and technological project elaboration for new industrial facilities;
- Defining and organization of pilot plants in the field of mineral processing and other technologies for the commercial products experimental production.

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P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs- E-mail: z.bartulovic@itnms.ac.rs

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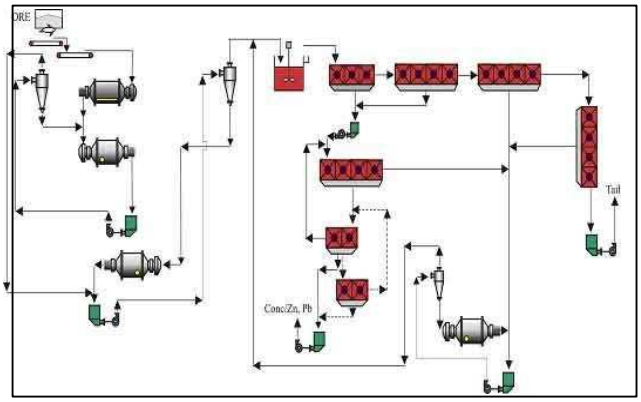

ENGINEERING AND MONITORING CENTRE

FIELD: In the department for monitoring, verification and realization of developed engineering solutions industrial application, the projecting and realization are accomplished in the fields of: processing and utilization of disposable raw materials; synthesis of ceramic, inorganic, metallurgical materials and materials for environment protection.

PROJECTING: of developing engineering solutions, based on process results checked in semi-industrial or industrial conditions, is performed according to procedure:

- elaboration of clipped techno-economic feasibility study ;
- general project elaboration, according to legal acts and industrial plant standards, equipped with detailed techno-economic analysis;
- main project elaboration, provided with environment protection study, according to global legal acts.

REALIZATION: of main project for developed engineering solutions is accomplished through:

- building inspection, production line installing, all process phases connecting, scheduled production balance;
- facilities running in, verification parameters of projected engineering solutions;
- continual supervision of plant working.

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P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs- E-mail: z.sekulic@itnms.ac.rs

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LABORATORY FOR PHYSICAL-CHEMICAL PROCESS FUNDAMENTALS AND MATERIAL CHARACTERIZATION

FIELD:

Fundamental, applied and developing research of mineral and secondary raw materials:

- Physical-chemical fundamentals acquiring for technology of mineral processing;
- Definition the parameters for new materials obtaining with designed characteristics (surface charge, cation exchange capacity (CEC), adsorptional properties, reaction type, etc);
- Parameters optimization for defining the technology of mineral processing (zelites, bentonites, kaolins, sepiolites, etc);
- Technology parameters check-out in semi-industrial conditions;
- Determination parameters needed for processes and equipment choice;
- Defining optimal parameters which determining the quality, applicability and product value.

EXAMINATION:

- **Physical-chemical and physical characterization of siliceous, aluminium-siliceous, carbonaceous, phosphatic, sulphatic, boratic, oxidative minerals, as well as pure salts and oxides, encompasses:**
  - **Adsorptional properties** (CEC, adsorption of mineral oils, organic cations, aqueous vapour);
  - **Physical characteristics** (bulk weight, specific weight, grain size, specific activity area, colour, porosity, angle of repose, etc);
  - **Physical-chemical and technological characteristics of raw materials and products** (DTA/TGA, rheologic properties, ductility, electro conductivity, pH value, shrinkage due to drying and annealing, bending strength, colour of ignition, total and apparent porosity, refractoriness, dilatation, sintering, clinkering, acidic stability).
- **Technological examinations of nonmetal minerals improving and modification:** classifying optimization; mineral choice; alkaline, acidic and organic modification; high voltage ground electrode electric properties improving; process optimization of designed materials obtaining and needed quantities production for certification.

Technological examinations of applying efficiency of obtained materials for toxins, radio nuclides, organic and inorganic ground and water pollutants adsorption.

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P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs, e-mail: a.dakovic@itnms.ac.rs

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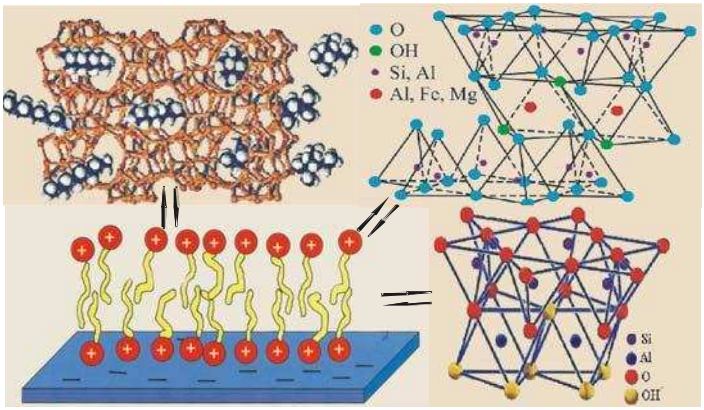

LABORATORY FOR ORGANIC-MINERAL AND OTHER COMPLEX MATERIALS

FIELD: Fundamental, applied and developing research of mineral surface modification (zelites, bentonites, kaolins, sepiolites etc), as the foundation for organic-mineral and other complex materials production:

- **Reaction filters** for filtration waters contaminated with different cations, anions and organic pollutants;
- **High efficiency mineral adsorbents** for adsorption of toxins, myco-toxins, toxic metals (including radio nuclides), which may be present in cattle food;
- **Filtration additives** for clarification of eaten oil, wine, beer, juices and for clarification and decolourization of coloured water.
- **Adsorbents** for ammonia adsorption in fish ponds, ambient conditions correction at farms, heavy metals and radio-nuclides adsorption from soils, adsorption of war gasses and other toxic materials.
- **Rheologic additives** for organic, aqueous and heterogeneous systems, fillers for polymer systems, bearer from pesticides etc.
- **Substances and products** based on natural mineral raw materials for healthy food production, donors of macro and micro elements.

EXAMINATION:

- Improving and refinement of non-metal raw materials to obtain as clean as possible monomineral products (clinoptilolite, montmorilonite, kaolins etc).
- Optimal conditions definition for modification minerals (clayey, zelitic etc) with inorganic cation; donors of macro and micro elements obtaining.
- Defining the characteristics of products obtained by non-metal minerals modification, intended for reaction filters production.
- Fundamental, developing and applied research for obtaining organic complex of bentonitic and kaolinic clays with primary and quaternary amines and other inorganic cations, as the basis for production and application of these materials (rheologic additives, fillers, bearers etc).
- Defining formation conditions of zelite mineral complex (clinoptilolite) with quaternary amines for obtaining the high quality adsorbents of myco-toxins and other toxins present in cattle food.

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs , e-mail: j.lemic@itnms.ac.rs

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Institute for Technology of Nuclear and other Mineral Raw Materials

LABORATORY FOR RESEARCH AND APPLICATION NEW TECHNOLOGIES AND MATERIALS IN AGRICULTURE

Fundamental, applied and developing research of mineral and secondary raw materials and products

- Obtaining products and substances, based on natural mineral raw materials, which should contribute the production increase of hygienic and healthy safe food, both vegetable and animal originated, without harmful matter.
- Biological parameters defining, which new products based on natural mineral raw materials should obey.
- Efficiency of new products examination (adsorption of toxins, radio-nuclides, organic and inorganic water pollutants, etc) and technological parameters defining for their use in regular production.
- Monitoring the new products application for their quality improvement.
- Optimal parameters referring to quality, application and valuation of obtained products defining.

Technology transfer

- Introducing and application the new products and substances based on natural mineral raw materials and modern technologies into agricultural production (soil utilization, food production, cattle nourishment, etc)

Customer education

- Scientific and professional lectures, senminars, new technological solutions presentation.

Services

- Soil fertility control.
- Physical-chemical parameters control of mineral composts.
- Recommendation the use of mineral composts.
- Projection of nourishing technology, mixtures recipes and complete meals for different categories of domestic animals.
- Analysis of production, reproductive and health results on farms.

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P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs E-mail m.adamovic@itnms.ac.rs

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LABORATORY FOR CERAMICS

ACTIVITY:

Fundamental, applied and developing research of ceramics.

Fundamental investigations: encompass operations and process investigations which refer to:

- ceramic materials synthesis from components obtained from natural mineral raw materials or chemical synthesis (sol-gel, spray pyrolysis);
- components consolidation (cold and hot);
- single-phase and multi-phase dispersed systems sintering in the solid state, or in the liquid phase presence.

Fundamental investigations regarding following ceramic materials:

- ceramics for electrotechnics;
- electronic ceramics;
- constructional and fine ceramics;
- refractories;
- composites.

Applied and developing investigations:

Proceed in cooperation with ceramic material producers through mutual projects sponsored by Ministry for Science, Technology and Development of Republic of Serbia, or by bilateral cooperation.

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LABORATORY FOR GLASS AND CERAMICS

ACTIVITY:

Fundamental, applied and developing research in the field of glassy and glass-ceramic materials.

Fundamental research:

Encompass phenomena and processes which refer to:

- examination and establishing of domestic raw material resources using to obtain the glassy and glass-ceramic materials;
- synthesis of new oxide, non-oxide and mixed anion-glass and glass-ceramics;
- research and development of new procedures for synthesis of glassy and glass-ceramic materials (non-conventional melting procedures, vapour deposition, etc)
- kinetics and mechanism of diffusion in glassy materials,
- kinetics and mechanism of nucleation in glassy materials,
- kinetics and mechanism of crystal qrowth in glassy materials,
- glassy materials sintering.

Fundamental investigations refer to next glassy materials:

- oxide and non-oxide glass,
- technical and optical glass
- technical and constructional glass-ceramics,
- special glass-ceramics (transparent, porously, fire proof, semi-conductable, ferromagnetic, etc),
- bio glass-ceramics
- composites.

Applied and developing investigations:

Proceed in cooperation with glassy material producers through mutual projects sponsored by Ministry for Science, Technology and Development of Republic of Serbia, or by bilateral cooperation.

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EXPERIMENTAL PRODUCTION OF SPECIAL MATERIALS BASED ON MINERAL RAW MATERIALS

FIELD: SPECIAL AGRICULTURAL MATERIALS

Acceptors:

-Adsorbents of myco-toxins
-Adsorbents of radio-nuclides
-Anion pollutants adsorbents
-Adsorbents of organic pollutants
-Humidity adsorption medium

Correctors:

- of pH-value
- of silage quality
- of soils chemical properties
- physical-mechanical soils properties
- substances for clarification
- suspension stability

Donors:

- of macro elements (Ca,Mg,P,K,N,…)
- of micro elements (Fe,Cu,Mn,Zn,Se ,Co…)
- of macro and micro elements

Modulators:

- of nourishing substrate
- Substances for seed germination preservation

MATERIALS APPLIANCE

PRODUCTION FOR FARMS

PLANT PRODUCTION

ACCEPTORS

Min-a-Zel
Min-a-Zel Plus P
Min-a-Zel Plus D
Ambizel V
Ambizel P
Petzel P
Petzel M
Petzel T

CORRECTORS

Min-a-Zel S
Mix Plus

CORRECTOR

Silak RZ-9

DONORS

Lifos
Agrozel
Ferti-Zel
Fungi-Zel

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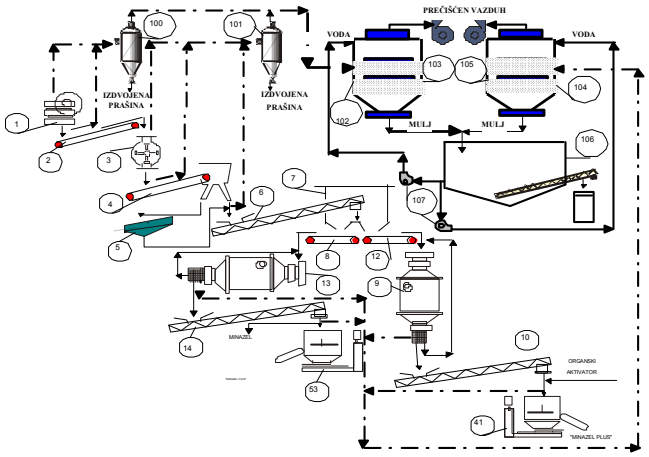

EXPERIMENTAL PRODUCTION OF SPECIAL MATERIALS BASED ON MINERAL RAW MATERIALS

FIELD: SPECIAL MATERIALS FOR INDUSTRY

ADSORBENTS	ADDITIVES	FILLERS
Adsorbents of heavy metals and radio-nuclides from soils, of war-gasses and other toxic materials; for humidity adjustment, for filtration water contaminated with different cations, anions and organic pollutants.	**Filtration additives** For clarification of wine, beer, juices and for clarification and decolourisation of coloured water. **Rheologic additives** for organic, aqueous and heterogeneous systems, fillers for polymer systems, bearer for pesticides, improving soils conduction.	**Natural fillers** -aluminium-silicates -oxides -carbonates -sulphates **Synthetic fillers** **Special fillers** -farina cork -stone wool

MATERIALS APPLICATION

ADSORBENTS	ADITIVES	NATURAL FILLERS	SYNTHETIC FILLERS
PRODUCTS Zeo-ad Sorb Vodo-stab Clay MDH-G Activated bentonite Activated kaoline Kalcofil	**PRODUCTS** Orfiben Bent-a-gel Slomax Bentocit Diatomitic soil	**PRODUCTS** **Silicates:** talk, kaolin, mica, feldspar, wollastonite, shale. **Oxides:** quartz, diatomitic soil . **Carbonates:** calcite, magnesite, dolomite, chalk. **Sulphates:** barytes, gypsum. **Special products:** stone wool.	**PRODUCTS** **Silicates:** Ca-silicate, Mg- silicate. **Oxides**: amorphous SiO_2, precipitated SiO_2, MgO, ZnO, TiO_2. **Carbonates:** Precipitated $CaCO_3$ **Sulphates:** Precipitated $BaSO_4$. **Special products:** Glass pearls Glass fibres
INDUSTRY Glass industry Water-supply Metallurgy Rubber industry Oil industry	**INDUSTRY** Metallurgy Electro industry Vine, beer, and juices production	**INDUSTRY** Ceramic, Glass, Refractory, Rubber, Plastics, Dyes and lacquer.	

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EXPERIMENTAL PRODUCTION OF SPECIAL MATERIALS BASED ON MINERAL RAW MATERIALS

FIELD: **High Quality Special Products Obtaining by Raw Materials Treatment**

Non-metallic raw materials

nmnmmm

(quartzic sandstone, quartzic sand, quartzic gravel, quartzite and hydrothermal quartz).
- **Kaolin, feldspar, mica, quartz** (white granite, kaolinitic granite, pegmatite, quartz-feldspar-mica sand).
- **Carbonated** (Ca-carbonaceous raw materials, Ca-Mg carbonaceous raw materials, Mg- carbonaceous raw materials).
- **Clays** (kaolinic, illitic, bentonitic).
- **Other mineral raw materials** (barytes, borates, fluor spar, wollastonite, talc, dunite).
- **Synthetics** (synthetic mulite, electro-melted quartz, synthetic gypsum, synthetic wollastonite).

Metallic raw materials

Magnetite
Titanium magnetite
Titanium
Nickel
Molybdenum
Bauxite
Precious metal

Secondary raw materials

Production waste materials:
- **exploitation, mineral processing/concentration** (waste material, refuse slate, sticky gaunge,).
- **metallurgical production** (calcined pyrites, casting and granulated slags, non-ferrous metal raw materials).
- **thermal energy production** (thermal plant slags, ashes from thermal plant electro-filters).
- **chemical production** (cement production ashes, high smokestack's and their filters crock)
- **inorganic materials production** (ceramics, glass, constructive material, refractories, special materials).

TECHNOLOGY OPERATIONS

Magnetic concentration

Wet procedure
Magnetic induction
Range 0.5T - 2.0T

Screening conveyor
Screening drum
High grade magnetic separator

Dry procedure
Magnetic induction
Range 0.5T -2.0T

Electrostatic concentration

Dry procedure
Electrostatic field between electrodes is produced using voltage in the range of 0 – 20000V.

Garnet
Zircon
Mica
Rutile

Gravity concentration

Fluid: water
Settling machine
Shaking table
Spiral concentrator

Fluid: dense medium
P-T analysis
Conic concentrator

V

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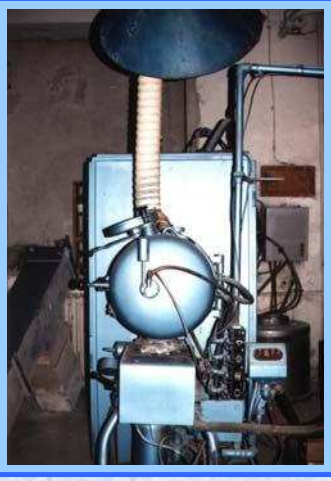

LABORATORY FOR EXTRACTIVE METALLURGY

Investigations for establisment new technologies and engineering solutions to obtain non-ferrous, rare and precious metals out of standard and non-standard, primary and secondary raw materials.

The following processes are used for successful realization of investigation programs:

PYROMETALLURGICAL PROCESSES:

-oxidation
-reduction
-distillation
-rectification
-sublimation
-dissociation

HYDROMETALLURGICAL PROCESSES:

At normal temperatures and pressures	At elevated temperatures and pressures
-leaching	
-solution purification	
-crystallization	
-metal compounds precipitation	
-solvent extraction	
-case hardening	
-ion exchange	

ELECTROMETALLURGICAL PROCESSES:

-electro melting of metals and metal compounds
-melt electrolysis

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-15-86, fax: +381-11-369-15-83
http://www.itnms.ac.rs - E-mail: z.gulisija@itnms.ac.rs

ITNMS

Institute for Technology of Nuclear and other Mineral Raw Materials

LABORATORY FOR METAL PROCESSING IN LIQUID STATE

Improvement of existing and new technological procedures establishing for production of key-al oys and al oys of special, non-ferrous and rare metals.

Improvement of existing and establishing new technological procedures for iron-based al oys production.

Design the technological procedures for cast production.

Establishing technological procedures of investment casting using fusible models.

Establishing new, improving the existing technologies and invention specific solutions for manufacturing mould- and core- mixtures.

Chemical composition design and technological procedure determination to produce designed quality al oys.

-Alloys Mg (Mg-Zn-Zr-Th)

- Alloys Ti (Ti-V, Ti-Al-Mo)
- Alloys Co (Co-Cr-Mo)
- Alloys in system Fe-Fe_3C (special, microalloyed steels (0,003%B), stainless steels,
- Ni-based alloys (713C, Hasteloy, Monel, IN100)
- Zn alloys (Zn-Al,Zn-Al-Cu,)
- Cu alloys (brass and bronze)

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http://www.itnms.ac.rs - E-mail: z.gulisija@itnms.ac.rs

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LABORATORY FOR REFRACTORIES AND METALLURGICAL MATERIALS

Establishing manufacturing technology of metal powders with special characteristics.

Establishing the technology of manufacturing auxiliary metallurgical materials.

Establishing manufacturing technology of shaped and powdered products based on highly refractory materials.

Establishing the technology of manufacturing Al-based metal-matrix cast composites.

- Co powder
- Ni powder
- Al-based metal-matrix composites
- Corundum
- Mulite
- Lamellar alumina
- High-refractory bowls for cupola furnaces
- Sinking discharge
- Inoculants
- Degasifying agents
- Fluxing agents
- Exothermic mixtures
- Refractory ramming mixtures

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ITNMS

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LABORATORY FOR CHEMICAL AND ELECTROCHEMICAL SYNTHESIS

Investigations, development and establishing chemical and electrochemical synthesis technologies and engineering solutions for obtaining pure inorganic salts, as well as other inorganic chemicals with specific purpose. For successful achieve research and development programmes, actual scientific and engineering methods are used. Organization, methodology and coverage all the researchnig aspects in the field of chemical technology are assurance for accurate and high-quality results:

Chemical and electrochemical synthesis

Fundamental research:

- Homogeneous chemical and electrochemical reactions in liquid phase.
- Heterogeneous chemical and electrochemical reactions at phase boundary.
- Determining kinetics and order of reaction for chemical and electrochemical synthesis reaction.
- Temperature, cooling rate and solution stirring influence on the shape and growth of crystals in crystallization process.
- Pressure vs. temperature ratio influence on control the water of crystallization content in inorganic polycrystalline hydrates.
- The type of material and surface contour of electrodes influence on electrochemical reactions kinetics.
- Electrochemical oxidation of anodal material and metal hydroxide forming.
- Electrochemical synthesis of metal hydroxide influenced by alternating current.

Development, technologies, products:

- Technological procedures of pure salts synthesis for all purposes (sodium, potassium, calcium, magnesium, cobalt, manganese, copper, nickel, zinc, tin, lead, molybdenum, and selenium salts for laboratory use)
- Technological procedures and chemical synthesis of products with special purpose (pharmacy, food industry, veterinary, electronics...)
- Secondary raw materials recovery as the primary raw mateials in chemical and electrochemical synthesis reactions.
- Natural mineral raw marterials valorization as raw materials in chemical synthesis reactions.
- Technological process of metal hydroxides electrochemical synthesis (cobalt hydroxide, ferri-hydroxide, zinc hydroxide, copper hydroxide)
- Engineering parameters defining to establish a experimental production.
- Engineering parameters defining for production facilities projection.

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs - E-mail: v.vidojkovic@itnms.ac.rs

ITNMS

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LABORATORY FOR MECHANOCHEMICAL SYNTHESES

Investigations, development and establishing mechanochemical syntheses technologies and engineering solutions to obtain substances with specific physical-chemical characteristics and for specific purposes. For successful achieve research and development programmes, actual scientific and engineering methods are used. Organization, methodology and coverage all the researchnig aspects in the field of mechanochemistry are assurance for accurate and high-quality results:

Mechanochemical syntheses

Fundamental research:

- Mechanochemical syntheses in reactions of neutralization, oxidation-reduction and ion exchange.
- Mechanical energy influence on mechanism of solid state chemical reactions.
- Mechanism of crystal structure destruction, as the first stage in mechanochemical synthesis reaction.
- Amorphous phase of intermediate state as the rate limiting factor in mechanochemical syntheses reactions.
- Thermodynamic parameters of mechanochemical synthesis reactions determination to enable process parameters programming.
- Mathematical modeling of mechanochemical syntheses processes and determining relations between mechanical, thermal and chemical energy.
- Mechanical energy utilization factor calculation as the relation between mechanochemical synthesis reaction and mechanochemical reactor properties.

Development, technologies, products:

Technological procedures of mechanochemical synthesis:

- calcium titanate
- strontium titanate
- barium titanate
- sodium selenite
- sodium molybdate
- barium chromate
- sodium citrate
- Technological procedure of sodium carbonate mechanical activation.
- Technological procedure of mechanical activation raw materials for production the easy fusible glass.
- Engineering parameters defining for mechanochemical syntheses facilities projection.

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P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs - E-mail: v.vidojkovic@itnms.ac.rs

ITNMS

Institute for Technology of Nuclear and other Mineral Raw Materials

LABORATORY FOR CHEMICAL ENGINEERING

Field:

Fundamental, developing and applied investigations.

Research:

Fundamental research of finely dispersed systems, analysis and modeling of dynamic systems in technological processes and operations evaluation are the scopes of this laboratory.

Besides, laboratory tasks are the process development and projecting the equipment and facilities for processing production waste materials from:

- Adsorption processes;
- Liquid-liquid extraction;
- Liquid-solid and solid-solid operations ;
- Alternative separating processes;
- Biochemical engineering.

Technologies, equipment and facilities are established based on investigations, what enabled all kinds industrial low metal content catalysts treatment to obtain environmental safe form. Process and the facilities are patent protected. Mobile facilities enable production waste materials treatment at originating place, what makes easy the waste disposal.

Other:

Beside the applied investigations of production waste materials processing, the methods for process analysis are developed, first of all experiment planning at facilities (plant).

- Design of experiments (DOE) and evolution planning (EVOP) ;
- Methods of risk assessment in working facilities ;
- Decision making systems (DMS).

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-15-86, fax: +381-11-369-15-83
http://www.itnms.ac.rs - E-mail: a.spasic@itnms.ac.rs

ITNMS

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LABORATORY FOR ENVIRONMENTAL PROTECTION

FIELD: Working and developing ITNMS strategy in the field of environmental protection and improvement is directed to fundamental and applied investigations:

- Air
  - Detection the state of air contamination;
  - Air quality control nearby industrial facilities (imission);
  - Emission measuring the harmful substances from combustion or other technological processes, and suggestion the measures for their emission decreasing;
  - The devices for gas treatment efficiennccy detection;
  - Engineering documentation elaboration and projecting the system for industrial waste gasses treatment.
- Water
  - Physico-chemical characterization of waste, drinking, underground and surface waters;
  - Project documentation elaboration and mechanical, chemical and biological treatment of waste waters realization;
  - Regeneration engineering of water-scooping objects;
  - Defining, production and application of new preparations for physical, chemical and biological regeneration of water-scooping objects.
- Soil
  - Soil characterization (presence of hard metals, radio-nuclides etc);
  - Project documentation elaboration for revitalization and recultivation of degraded soils (bio-technical, chemically-technological solutions etc);
  - Development and application "ex situ" and "in situ" technologies in contaminated soils refinement.
- Secondary raw materials and wastes
  - Identification and categorization of materials;
  - Engineering solutions of useful components, secondary raw materials and wasted materials recovery (projecting and accomplishing).

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs - E-mail: m.grbavcic@itnms.ac.rs

ITNMS

Institute for Technology of Nuclear and other Mineral Raw Materials

Experimental Production of Special Metal-Based Materials

PLASTIC FORMING OF METALS

1.Soldering alloys based on Pb-Sn

-PbSn30
-PbSn36
-PbSn50
-PbSn60
-as customer demands.

Alloys can be delivered in the form of:
-ingot;
-triangular rod 10x10x10x400mm;
-wire Φ 2,5mm; Φ 3mm; Φ 4mm; Φ 10mm or
-as customer demands.

2. Soldering alloys based on Pb-Sn-Ag

-Pb-Ag
-Sn-Ag
-Pb-Sn-Ag
-as customerdemands.

Alloys can be delivered in the form of: ingot, rod, wire and as customer demands.

3.Alloys with low melting point based on Bi-Pb-Sn-Cd

-Wood's metal Bi(50,0) Pb(25,0) Sn(12,5) Cd(12,5)
-Lipowitz's metal Bi(50,0) Pb(26,7) Sn(13,3) Cd(10,0)
-Rose's metal Bi(50,0) Pb(25,0) Sn(25,0)
-Newton's metal Bi(50.0) Sn(18,8) Pb(31,2)
-Lichtenberg's metal Bi(50,0) Sn(20,0) Pb(30,0)

4.Bushing metal based on : Cu-Sn-Sb-Pb

-Cu(4,5) Sn(91,0) Sb(4,5)
-Cu(3,5) Sn(89) Sb(7,5)
-Cu(8,0) Sn(84) Sb(8,0)
-Sn(10,0) Sb(15,0) Pb(75,0)
-Sn(5,0) Sb(15,0) Pb(80,0)

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P.O. Box 390, . +381-11-369-15-86, fax: +381-11-369-15-83
http://www.itnms.ac.rs- E-mail: z.gulisija@itnms.ac.rs

ITNMS

Institute for Technology of Nuclear and other Mineral Raw Materials

Experimental Production of Special Metal-Based Materials

PROCESSING THE NON-STANDARD SECONDARY RAW MATERIALS

Researching to establish the technology and engineering solutions of processing and recovery the beneficial components out of secondary and non-standard metal raw materials to obtain metals, alloys and metal compounds.

-Processing of by-products from industry of: Pb, Zn, Cu, Al
-Processing of Sn, Pb, Pb-Sn-al oys (sponge, slag, sludge),
-Processing of Cu and Cu-alloys (slag, borings, chips)
-Processing of Zn and Zn-alloys (slags, borings, chips, sludges)
-Processing of Ni and Ni-al oys (Ni-Cd accumulators, sludges, catalysts, wasted electrodes)
-Mo-based solution processing

-Metals: Pb, Cu, Zn, Co, Ni, Sn

-Alloys: Pb-Sn alloys,

Cu- based alloys, Zn- based alloys,

Ni-based alloys

-Salts: Co, Ni, Zn

-Oxides: Co, Ni, Zn, Mo

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Experimental Production of Special Metal-Based Materials

FOUNDRY

THE MEDIUM FREQUENCY INDUCTION FURNACE SIP100/II OPERATES IN METALLURGY DEPARTMENT

FURNACE TECHNICAL CHARACTERISTICS :

- CONNECTION VOLTAGE	3x400/230V, 50Hz
- FURNACE POWER	100KW
- NOMINAL FREQUENCY	2000Hz
- STEEL CAST CAPACITY	100kg Fe
- NON-FERROUS METALS CAST CAPACITY	150kg Cu
- MAXIMUM CAST PRODUCTION AT CONTINUOUS OPERATING	140kg/h Fe, 200kg/h Cu
- OPERATING TEMPERATURE	1700°C
- COOLING	WATER,OPEN SYSTEM

WORKING PROGRAMME OF INDUCTIONAL FURNACE IN ITNMS

- *KEY-ALLOYS PRODUCTION WITH GUARANTEED CHEMICAL COMPOSITION.*
- *PRODUCTION CASTINGS MADE OF HIGH-ALLOYED STEEL, ALLOYED CAST STEEL, CAST IRON AND NODULAR CAST IRON.*
- *PRODUCTION CASTINGS MADE OF NON-FERROUS METALS STANDARD AND SPECIAL ALLOYS.*

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Experimental Production of
Special Metal-Based Materials

HYDROMETALLURGICAL METAL PROCESSING

Salts and metal oxides production
of technical grade and p.a. quality
out of primary and secondary raw materials

COBALT BASED PRODUCTS

COBALT NITRATE $Co(NO_3)_2x6H_2O$

COBALT CARBONATE BASIC $xCoCO_3.yCo(OH)_2$

COBALT SULPHATE $CoSO_4x6\text{-}7H_2O$

COBALT CHLORIDE $CoCl_2x6H_2O$

COBALT ACETATE $Co(CH_3COO)_2x4H_2O$

COBALT OXIDE

NICKEL BASED PRODUCTS

NICKEL SULPHATE $NiSO_4x6\text{-}7H_2O$

NICKEL CHLORIDE $NiCl_2x6H_2O$

NICKEL OXIDE

ZINC BASED PPRODUCTS

ZINC SULPHATE $ZnSO_4x7H_2O$

ZINCCHLORIDE $ZnCl_2$

ZINC OXIDE

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http://www.itnms.ac.rs - E-mail: z.gulisija@itnms.ac.rs

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SPECIAL PURPOSE CHEMICALS EXPERIMENTAL PRODUCTION

Eksperimental production of chemicals according to special quality requirements:

Pharmaceuticals and cosmetics:

- Sodium acetate 2 – hydrate
- Sodium acetate anhydrous
- Sodium citrate 2- hydrate
- Tri-Sodium phosphate 12- hydrate
- Di-Sodium phosphate 12- hydrate
- Sodium di-hydrogen phosphate 2- hydrate
- Magnesium sulphate 7- hydrate
- Copper sulphate 5- hydrate
- Potassium di-hydrogen phosphate
- Potassium chloride
- Calcium sulphate 2- hydrate
- Barium sulphate

Mineral & vitamin mixture for cattle food:

- Sodium selenite

Colours, paper, rubber, plastics:

- Calcium carbonate precipitated
- Sodium molybdate
- Barium chromate
- Copper carbonate basic

Laboratory chemicals (p.a.):

- Copper based salts (copper oxide, copper carbonate basic, copper chloride, copper sulphate)
- Barium based salts (acetate, chloride, carbonate, nitrate)
- Zinc based salts (nitrate, sulphate)
- Potassium based salts (phosphate, chloride, nitrate, sulphate)
- Magnesium based salts (chloride, sulphate)
- Sodium based salts (chloride, phosphate, acetate, bicarbonate, carbonate, molybdate, nitrate)
- Lead based salts (chloride, acetate, nitrate)

Food industry:

- Potassium nitrate
- Sodium nitrate

Metal coatings:

- Tin chloride

Water treatment:

- Tri-Sodium phosphate 12- hydrate

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-17-22, fax: +381-11-369-15-83
http://www.itnms.ac.rs - E-mail: v.vidojkovic@itnms.ac.rs

ITNMS

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LABORATOROY FOR CHEMICAL INVESTIGATIONS

FIELD:

Chemical examinations of natural and synthetic materials (geological, technological, metallurgical and other technical materials) in the scope of applied, developing and fundamental research:

- inorganic materials,
- metal and alloys,
- ores and minerals,
- sewage,
- secondary raw materials,
- soils,
- plants,
- cattle food,
- motor oils etc.

Quantitative examination results are elementary parameters of Institute's projects and elaborates, as well as the need in many firms and scientific institutions.

EXAMINATIONS: Analytical material examinations encompass:

- Quantitative and qualitaitve determination, using AA Spectrophotometry, of micro and macro cation content of: Al, Ca, Fe, Sn, Zn, B, Ni, Cr, Mn, Sb, Cu, Mo, Ti, Pb, W, Si, Bi, V, Cd, Na, K, Li, Sr, Co and preceous metals Au, Ag, Pt, Rh, Pd;
- Spectrophotometric cation and anion determination;
- Gravimetric and volumetric determination of macro elements and anions;
- Complete silicate analysis;
- Impurities content in chemical of technical grade and p.a. quality;
- Fluorimetric uranium determination;
- Phase analysis of Cu, Pb, Zn and Fe cation.

OTHER:

- New analytical methods development and existing methods improvement within available emission and apsorptional techniques.
- Methods standardization in accordance with Federal Standards Institution and interlaboratorial contiguous examinations.
- Quality system maintaining in accordance with JUS ISO 17025 standard and report certifying according to accreditation field.

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-15-86, fax: +381-11-369-15-83
http://www.itnms.ac.rs E-mail: m.stojanovic@itnms.ac.yu a.brankovic@itnms.ac.rs

ITNMS

Institute for Technology of Nuclear and other Mineral Raw Materials

LABORATORY FOR MINERALOGICAL INVESTIGATIONS

FIELD: Fundamental, developing and applied research of natural and synthetic materials in the scope of geological, technological, metallurgical and other technical fields:

- Structural-textural and paragenetic-genetic characteristics of ores, industrial and agricultural raw materials.
- Mineralogical investigations in the scope of mineral processing (metallic and non-metallic).
- Technical mineralogy in the scope of ferrous and non-ferrous metallurgy.
- Technical mineralogy in the scope of synthetic materials.
- Mineralogical definition of precious metal minerals (Au, Ag, PGE), as well as their condition and distribution in polymetallic deposits of copper, lead, zinc etc.

ANALYSIS:

- Qualitaitve mineralogic microscope analysis of metallic and non-metallic ores, flotational and final products.
- Quantitative microscope analysis of metallic ores and flotational products
- Visual informations quantifying from optical and electronic microscope – acquisition, processing, measurements, statistics, microphotography.
- Crystallographic methods use with metallic and non-metallic ores, flotational and final products.
- Qualitaitve and quantitative x-ray powder analysis (inner standard and direct method), unit cell parameters determination (crystal lattice), microstructural parameters determination of crystal materials of any origin (crystallite size, crystal lattice micro-strain, dislocation density).

OTHER:

- Project elaboration on the development and improvement auxiliary materials for ferrous, non-ferrous and percious metal production.
- Industrial minerals examination in the light of usefulness in industry of ceramic and refractory materials, as well as non-metal and constructive materials industry.
- Data bank establishing to archive all mineralogical investigations, with the quantified visual information as the basis (application softver development).
- Precious metals (Au, Ag, PGE) defining and distribution in ores in the function of their utilization during concentration process.

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http://www.itnms.ac.rs - E-mail: s.radosavljevic@itnms.ac.rs

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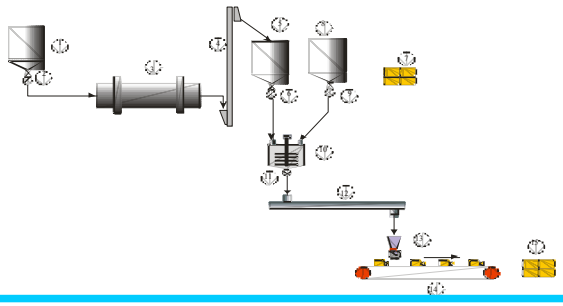
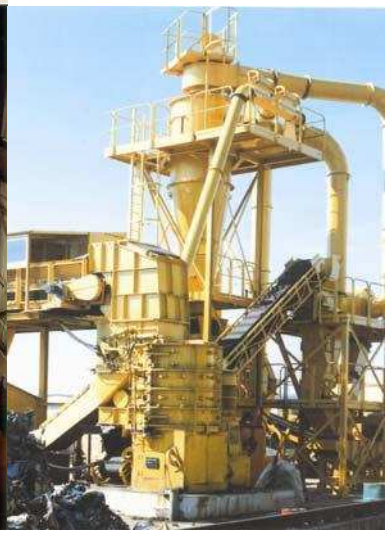


Institute for Technology of Nuclear and other Mineral Raw Materials

Projecting and Engineering Solutions Developing in Technology

In ITNMS' department for monitoring, verification and realization the industrial application of developed engineering solutions, the projecting and realization are accomplished in the fields of: processing and utilization of disposable raw materials, synthesis of ceramic, inorganic, metallurgical and environment protection materials.



- Developed engineering solutions projecting, based on process results verified in semi-industrial and industrial conditions:
  - elaboration of clipped feasibility study;
  - general design elaboration, according to legal acts and industrial plant standards, equipped with detailed techno-economic analysis;
  - main project elaboration, provided with environment protection study, according to global legal acts.

- Main project realization for developed engineering solutions is accomplished through:
  - building inspection, production line installing, all process phases connecting, scheduled production balance;
  - facilities running in, verification parameters of projected engineering solutions;
  - continual supervision of plant working.

Fran{e d'Eperea 86, 11000 Beograd, 390, . (011) 369-17-22, . (011) 369-15-83
http://www.itnms.ac.rs- E-mail: vecko@itnms.ac.rs

ITNMS

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Information System Department

Information system in ITNMS is developed to serve for organization and management, research and development, scientific and engineering operation, achieved results verification, as well as experimental production, projecting and engineering.

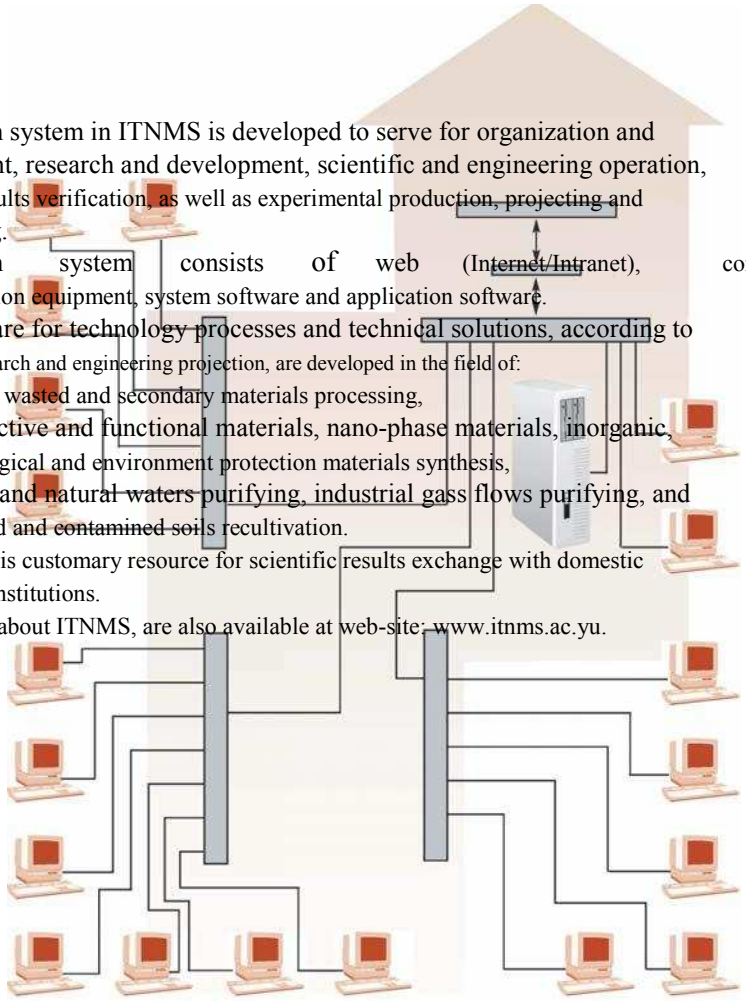
Information system consists of web (Internet/Intranet), computers, communication equipment, system software and application software.

New software for technology processes and technical solutions, according to scientific research and engineering projection, are developed in the field of:

- mineral, wasted and secondary materials processing,
- constructive and functional materials, nano-phase materials, inorganic, metallurgical and environment protection materials synthesis,
- wasted and natural waters purifying, industrial gass flows purifying, and degraded and contamined soils recultivation.

The Internet is customary resource for scientific results exchange with domestic and abroad institutions.

Information about ITNMS, are also available at web-site: www.itnms.ac.yu.



Fran{e d'Eperea 86, 11000 Beograd, 390, . (011) 369-17-22, . (011) 369-15-83
http://www.itnms.ac.rs - E-mail: vecko@itnms.ac.rs

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Nuclear Technologies

55 YEARS OF RESEARCH & DEVELOPMENT TRADITION
FROM LABORATORY TO FINAL PROJECT

NOWDAYS IN ENVIRONMENT PROTECTION

URANIUM SEPARATION TECHNOLOGIES

1. uranium separation from ores
2. uranium obtaining out of non standard sources (phosphoric acid; coal ashes)

TECHNICAL GRADE URANIUM CONCENTRATE REFINMENT TO OBTAIN NUCLEAR GRADE PURE URANIUM SALTS

TECHNOLOGIES AND MATERIALS FOR CONTAMINATED SOILS REMEDIATION

URANIUM MONITORING AND DETECTING IN ORES, SOIL, WATER AND MATERIAL OF HUMAN ORIGIN

86 Franchet d'Esperey Str. 11000 Belgrade, Serbia and Montenegro
P.O. Box 390, . +381-11-369-15-86, fax: +381-11-369-15-83
http://www.itnms.ac.rs - E-mail: m.babic@itnms.ac.rs

Fundamentalna, primenjena i razvojna istra`ivanja kao i laboratorijske usluge ispitivanja u prirodnim i tehni~ko-tehnolo{kim naukama

Fundamental and Applied Scientific Research, Research and Development, and related Analytical Methodology in Natural and Engeneering Sciences

Franše d'Eperea 86
Beograd

tel: 011/ 3691-722, 011/ 3691-584
fax: 011/ 3691-583

www.itnms.ac.rs
e-mail: itnms@itnms.ac.rs