SERVICES

Laboratory for microelectromechanical processing systems

Services:

1. Processing by electrical erosion
   - Working through wired electrical erosion- on CNC machine manufacturer SMART DEM, Germany Knuth
     Characteristics:
     Number of axes 4 - x / y, u / v,
     Dimensions 250x350x200mm processing,
     Positioning accuracy 0.02 mm.
   - Working through electrical erosion with massive electrode - on EDM machine ZNC-210 manufacturer Knuth Germany

   Characteristics:
   The maximum electrode 314 mm2,
   Dimension of piece max. 200x200mm,
   Z height of 90mm.

2. Micromechanical processing
   - micromechanical processing on CNC Center in 5-axis - the car manufacturer KERN Micro KERN Germany
     Characteristics:
     Dimensions 250x220x200mm processing,
     Precision positioning 0.001 mm,
     0.001 mm repeatability,
     Main axis speed max. 50 000 rpm,
     Minimum diameter for drilling and milling 0.03 mm.
   - micromechanical processing CNC center in 3 axis, car TMV400, manufacturer Taiwan Topper
     Characteristics:
     Dimensions 400x250x250mm processing,
     Positioning accuracy 0.01 mm,
     0.003 mm repeatability,
     Main axis speed max. 12 000 rpm,
     Maximum diameter of tool 80 mm.

3. Outturn coils on automated machines
   - Outturn toroidal coils on SMC-1 machine, producer JOVIL U.S.
     Characteristics:
     Conductor size 0.05 ÷ 1.2 mm
     Tor minimum inside diameter 8mm,
     Tor maximum outer diameter of 63mm,
     Tor Maximum Height 50.8 mm.
   - Outturn cylindrical coils on the machine TAK-01 producer NITTOKU Japan
     Characteristics:
     Conductor size 0.01 ÷ 1.2 mm
     Longitudinal field of 100mm,
     Maximum outer diameter of coil 140mm,
     Winding step adjustable in the range 0 ÷ 9.999 mm
     cross coil section: circle, square, rectangle, ellipse, etc.

4 Laser micromachining
   - Excimer pricessing laser station, Coherent, SUA

   Wavelength : 248 nm
   Maximal power : 25 W
   Pasitioning accuracy 0.005 mm

5 Micromechanical processing using LIGA technology
   - Laser litigraphy system DWL 66FS

   Wavelength : 248 nm
   Average power :18 mW
   Minimum structure size 1μm
   - Remote Microwavw Plasma Etcher for SU8 rezist
     Max. Power :2000 W

SERVICES

Laboratory of bioelectromagnetic compatibility

Services:

In the laboratory measurements are made on:

- spectral analysis of infrared images for electrical circuits, PCB boards, fire prevention, electrical connections, buildings, etc.;
- THz reflection spectroscopy;
- THz transmission spectroscopy;
- materials characterization;
- analysis of crystalline structure and polymorph substances;
- study of surfaces and solids interfaces, liquids, polymers.

Equipment used in the laboratory:

- Chamber of thermo vision FL-IR
- THz spectrometer with geometry operating: transmission & reflection

Laboratory for evaluation of thermal behavior of products and materials by thermal analysis

Services:

- thermogravimetry analysis (TG)
- derivative thermogravimetry analysis (DTG)
- differential thermal analysis (DTA)
- differential scanning calorimetry (DSC)
- dilatometry (DIL)
- dynamic mechanical analysis (DMA)

By using the apparatus of equipping the laboratory is obtained a "thermal spectrum" (thermogram) of the complex material, which can lead directly:

- temperatures occurring at the phase transitions (melting, softening, vitreous transition);
- temperature field in which the material is thermally stable;
- temperature field in which the material is stable to thermal oxidation;
- dimensional change and mechanical properties of a material as a result of warming;
- effects of thermal processes emphasized in thermograms;
- calorific capacity change that takes place at a vitreous transition.

By processing data obtained by thermal analysis with apparatus of the endowment may lead indirectly to:

- crystal degree;
- use of the compounds used for the production of composite materials;
- physicochemical mechanisms processes emphasized in thermograms;
- kinetic and thermodynamic parameters of these processes;
- relative thermal stability to heat or thermo-oxidative;
- relative effectiveness of antioxidants;
- optimal composition of a composite material, properly used;
- thermal endurance (life meters) of a material or product to a proper use of a certain criterion and end of life;
- stability of ceramic or metallic materials depending on temperature;
- the effect of ingredients on the expansion coefficient of a material;
- reproducibility of the production process of solid materials (quality control).

Laboratory of MEMS and NEMS Measurements

SERVICES

Services:

Specific measurements MEMS and NEMS:

- micro and nano angular or linear travel;
- microforces;
- viewing areas: micro and nano roughness, surface topology;
- speeds;
- acceleration;
- actuation views of specific micro and nano electromechanical sensors and actuators.

The laboratory is equipped with laser interferometric system Agilent, for micro measurement and linear and angular nanodisplacements with resolution+_ 2nm (linear for travel) and 20'' (for travel angular), and microdinamometers or independent feed finger systems.

Laboratory for characterization and testing of electrotechnical materials and products

Services:

- Full qualitative analysis (determination of phase, the network parameters, crystal size, texture and stress, layer thickness) of crystalline materials, X-ray diffraction equipment (with the possibility of performing measurements at temperatures between ambient temperature and +6000 C);
- Analysis of qualitative and quantitative elemental level ppm using atomic absorption spectrometry (AAS);
- Analysis of qualitative and quantitative elemental method of mass spectrometry (ICPMS);
- Analysis of qualitative and quantitative elemental method by electronic scan microscopy (SEM);
- Metallographic analysis;
- Analysis of rugged surfaces (with roughness of less than 5 μm) by atomic surface technique force(AFM)
- Determination of Brinell and Vickers hardness;
- Determination of Vickers and Knoop microhardness;
- Determination of resistance to traction, compression and bending;
- Determination of remaining magnetic induction;
- Determining the coercive magnetic field;
- Determination the specific magnetic energy;
- Determination of linear and/or angular nanodisplacements at actuators, micromotors or electromechanical microcomponents by laser interferometry;
- Determination of electrical conductivity of metals;
- Determination particle size average of pulverulent materials;
- Determination of O2, CO2, NO concentration, from the combustion gases;
- Determination of sulfur concentration in drinking water or wastewater;
- Determination of O2 concentration dissolved in drinking water or wastewater;
- Determination of the noise level assessment in industry.

Equipment used in the laboratory

X-ray diffractometer type D8 Advance, Bruker – AXS Germany - 2000	X-ray diffractometer type D8 Dicover, Bruker – AXS Germany – 2007
Atomic absorption spectrometer (AAS) type SOLAAR S4 Thermo Electron Corporation UNICAM USA – 2005	Mass spectrometer with laser ablation, Perkin Elmer USA – 2007

CP II Scanning Probe Microscope – Atomic force microscop – Veeco USA – 2005	Microhardmeter FM 700, AHOTEC Germany 2007
Mechanical testing machine type Zwick TR FR 005 TN – Zwick Germany – 2005	Histerezisgraph type AC/DC Hystograph - Brockhaus Messtechnik – Germany – 2005
Measurement system with linear and angular interferometer - Agilent USA -2006	Combustion gasses emision analyser type A97 - Wohler, Germany – 2006
Water analyser type PHOTOLAB S 12- WTW GmbH, Germany – 2006	Portable oxygenometer type OXI 315i- WTW GmbH, Germany – 2005
Portable sonometer Model 12- Pulsar Instruments Ltd. Great Britain – 2006	Optical microscope type NU 2 - VEB Carl Zeiss – Jena, Germany
Granulometer type FISCHER	

Laboratory for multifunctional metallic materials

Nanomaterials produced

1) Ni nanopwders;
2) Co, CoNi nanopwders and Co/Ag, Co/Al_2O_3 type core-shell powders;
3) Mg base composite materials for hydrogen storage;
4) Fe-Ti, Zr-Ni, Mg-Ni type materials for hydrogen storage;
5) Ni (Fe,Co)Al –B type materials with ferromagnetic properties;
6) silver colloidal solutions, chemically or electrochemically obtained, with antibacterial and regenerative properties, having applications in medicine, biology and consuming goods;
7) gold colloidal solutions, chemically obtained with applications in medicine and biology;
8) Ag/MeO (MeO = ZnO, TiO_2, CuO) nanocomposite powders, and Ag/$BaSO_4$ nanoparticles, chemically obtained, with antibacterial properties, having applications in medicine, cosmetic industry and consuming goods;
9) Ag/MeO (MeO = SnO_2, ZnO) nanocomposite powders chemically obtained, with applications in electrical engineering;
10) Ag/microcrystallineAg nanoparticles composite powders, chemically obtained, with applications in electrical engineering;
11) conductive paste of Ag/microcrystallineAg nanoparticles, with applications in electrical engineering;
12) hydrogel with Ag nanoparticles with antibacterial properties, having applications in medicine and cosmetic industry;

Products

- heat pipe and flat heat pipe micro-devices for the thermal management of electronic components

Equipments:

- *TG-DSC/DTA* instrument for thermodynamic parameters characterisation – enthalpy, specific heat, Curie temperature, weight variation as a function of the temperature program. Temperature domain: -150 + 1550 ^oC;
- *Autosorb 1* instrument for complete characterisation of powder, grain and pelet materials (catalysts carbons, ceramics, fillers, polimers). The Autosorb 1 measures the BET surface area (single and/or multipoint in range of

≥ 0,0005 m^2/g, when using kripton), Langmuir surface area, adsorption and/or desorption isotherms, pore size (in the range of 0,35 – 500 nm when using nitrogen) and surface area distributions, micropore volume and surface area. The Autosorb 1 is capable of measuring the adsorption of many non-corrosive gases: N_2, Ar, CO, CO_2, Kr, O_2, C_4H_{10};

- The *LFA 447 Nanoflash diffusivity* instrumentation can be used to measure the thermal diffusivity, specific heat and thermal conductivity of metals, graphite, coatings, composites, ceramics, polymers and other solid or liquid materials, within temperature range of 20 – 300°C.
- *UV/VIS/NIR Spectrophotometer* type V-570 Jasco (Japan)
  - standard module for liquid sample spectrum (colloidal solutions) and quantitative analysis measurements using the maximum absorption wavelength
  - integrating sphere of ISN-470 type for powder sample spectrum measurements, using the maximum reflectance or transmittance wavelength
- *90 PLUS Brookhaven (USA) nanoparticle size analyzer* for colloidal-sized materials, suspended in any clear liquid. It measures the particle size (range: < 1 nm to 6 μm depending on refractive index, concentration and scattering angle, with precision: ± 1 %) and zeta potential.

- *Planetary mill* with inert gas option for mechanical alloying of powders. Maximum capacity: 500 g.

Magnetic Materials Laboratory

- Hard magnetic nanocomposites based on rare-earths;
- Nanopowders based on magnetite for medical applications;
- Conductive, semiconductive, magnetic or magnetostrictive glass-coated microwires, with core from Cu, Pt, Co, Ni, Si, Ge or alloys (e.g., alloys based on the ternary system Fe-Si-B, Co-rich or Fe-rich alloys). The glass-coated microwires are formed from a metallic core in a cylindrical shape which is surrounded by a layer of isolator from glass, the diameter of the metal core can be from 1 to 50 μm and the thickness of the glass coating is from 1 to 20 μm. The length of a microwire can be 1 - 2 km.

It can be obtained differently structures of the metal core: polycrystalline with different sizes of crystals (microcrystallites, nanocrystallites) and amorphous.

Microwires applications is very large therefore, we mention just some:

- magnetic sensors with microwires;
- electromagnetic shielding;
- element for magnetic encoding;
- anti-shoplifting labels based on glass coated microwires;
- products and documents authentication, brand protection, and access control;
- under floor heating systems installed directly under all types of floor covering;
- conductors-micro cables for telecommunication;
- miniaturised high-voltage transformers.

Advanced Carbon Materials Laboratory

Technologies and procedures

- 4 inch photolithography line for nanometric resolutions.
- Serigraphy line for A0 formats, micron and under micro serigraphic layer size.
- Stencil cutter plotter, mechanical resolution of 10 microns for mask patterning.

SERVICES

- Magnetron sputtering, VUP 5M, three magnetrons, two DC for conductive targets and one RF 13,MHz for dielectric targets. PECVD in controlled environment (gas mixtures) and/or high vacuum.
- Scanning electron microscopy, microscope REM 100, 100000x.
- EDX, Inca Oxford Instruments.
- Atomic force microscopy, Veeco CPII, contact, non-contact and taping mode. Magnetic force microscopy - MFM, conductiv mode, nanolitography, nanoidentation.
- Agilent bridge for measureemnts in the range 20 Hz – 2MHz.
- Vector Analyzer Rhode Schwarz, 300kHz – 4GHz.
- Spectrum analyzer Rhode Schwarz, 9kHz – 13.6 GHz.
- Dielectric and magnetic measurement of the materials in line transmission up to 4 GHz.