



INSTITUTE OF NANOSCIENCE AND NANOTECHNOLOGY

Advanced Ceramics and Composites Laboratory

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The Advanced Ceramics and Composites Laboratory was founded in 1990 with initial emphasis on the development of advanced ceramic materials and ceramic-based composites. It has since grown very substantially and its main activities are now divided between research (for supranational and national authorities and industries) and services to industry.

On the basis of our very extensive facilities, we can offer the following testing and measurement services to industry and in particular to packaging and printing companies, most of them based on ASTM or EN standards as well as on UN Part III-2009 and EN 440-2008 transport regulations:

A. Mechanical Properties

- a. **Tensile strength and elongation** of plastics, paper, composites, wood etc. at room temperature and in an environmental chamber up to 200°C and 100% humidity.
- b. **Tensile strength and elongation** of all metals and alloys at room temperature and up to 800°C
- c. **Bending strength (Modulus of Rupture or Transverse Rupture Strength)** of all plastics, paper, composites, wood etc. from -196°C to room temperature and in an environmental chamber up to 200°C and 100% humidity.
- d. **Bending strength (Modulus of Rupture or Transverse Rupture Strength or Flexural Strength)** of ceramics, glasses and metals from -196°C to room temperature to 1250°C
- e. **Compressive strength** of all plastics, paper, composites, wood etc. from -196°C to room temperature and in an environmental chamber up to 200°C and 100% humidity.
- f. **Compressive strength** of all ceramics, glasses and metals from -196°C to 1250°C.
- g. **Shear strength** of all plastics, paper, composites, wood etc. from -196°C to room temperature and in an environmental chamber up to 200°C and 100% humidity.
- h. **Shear strength** of all ceramics, glasses, plastics, composites and metals from -196°C to 1250°C.
- i. **Fracture toughness** of all materials (in bending)
- j. **Young's and Shear modulus** of all materials in tension, bending and compression.
- k. **Impact strength (Izod and Charpy)** of all ceramics, glasses, plastics, composites, wood etc., up to 2.5Joules.
- l. **Impact damage** by a drop-weight test to 25Joules of all materials.
- m. **Bursting strength** of plastics
- n. **Adhesion strength** of glues and adhesives
- o. **Hardness** according to Rockwell, Brinell, Vickers for metals, glasses and ceramics
- p. **Microhardness** according to Knoop for ceramics, glasses and metals.
- q. **Scratch hardness** tests for plastics etc.
- r. **Abrasion (2-body or 3-body)** resistance for metals, plastics, composites and ceramics.
- s. **Cavitation erosion** of metals and ceramics
- t. **Creep resistance** of plastics, metals and ceramics to 1250°C

- u. **Air-born and water-born erosion** resistance for metals, plastics and ceramics.
- v. **Fatigue** resistance for plastics, wood, paper, card etc.
- w. **Friction** coefficient of all materials
- x. **Seal and peel** testing of adhesives and glues
- y. **Tear** properties of plastics, paper, card etc.
- z. **Puncture** resistance of plastics, paper, card etc
- aa. **Crushing** resistance (Hertzian or Brinell) of all materials
- bb. Mechanical properties under **vacuum**
- cc. **Isostatic** pressing (cold and up to 100°C)

B. Thermal properties

- a. **Thermal conductivity** of plastics, ceramics, glasses and metals and their composites from 20 to 800°C
- b. **Thermal expansion** of plastics, ceramics, glasses and metals and their composites from 20 to 600°C
- c. **Thermal heat capacity** of plastics, composites, inks, glue etc.
- d. **Self-ignition** temperature of plastics, paper, card, ink, wood, glue, paint etc.
- e. **Self-heating** of solids
- f. **Combustion temperature** of soot, coal and other fuels.
- g. **Flammability** of plastics, paper, card, wood, ink, glue, paint etc.
- h. **Flash point (open or closed cup)** of inks, adhesives, glues, paints etc.
- i. **Combustion sustainability** of liquids, inks, paints, glues etc.
- j. **Explosive** properties of solids and liquids
- k. **Freezing and heating** curves from -30 to 100°C in insulation containers
- l. **Thermal cycling** tests from -196 to +80°C for all plastics and composites.
- m. **Thermal quench** (shock) tests for ceramics and metals up to 1500°C
- n. **Sintering** of compacted metal and ceramic powders and **heat treatment** of all materials to 1600°C under air, vacuum or protective atmospheres
- o. **Aging and weathering** of plastics, paper, composites, card, wood, inks, glue etc. under full spectrum and/or UV irradiation in environmental chamber to 100% humidity and up to 50°C.
- p. **Diffusion bonding** of plastics and metals
- q. **Melting temperature** of metals and ceramics to 1800°C
- r. **Softening temperature** of plastics and composites
- s. **Exothermic (combustion)** synthesis of metals and ceramics
- t. **Pyrophoric** properties of solids and liquids
- u. **Flammable gas emission** from liquids
- v. **Microwave heating** and heat treatments
- w. **Mechanical milling** and alloying of powders
- x. **Thermal spray-coating** of plastics, metals and ceramics
- y. **Inductive heating** and alloying of metals

C. Chemical Properties

- a. **Atomic-structural** analysis using XRD
- b. **Elemental analysis** using EDX and XRF
- c. **Molecular mass** of polymers.

- d. **Chemical resistance** of all materials
- e. **Gas Chromatography**
- f. Determination of air **pollutants** (PM2.5, PM10, CO₂, CO)
- g. **Solvent separation** of paints, glues, inks etc.
- h. **Oxidation resistance** of all materials to 1250°C
- i. Test for **oxidizing substances**
- j. **Corrosion** tests for metals
- k. **Catalytic measurements** for various industrial and environmental processes
- l. **Atomic Absorption Spectroscopy**
- m. **Water solubility**
- n. **Solubility** in organic diluents

D. Physical, metallurgical and optical properties

- a. **Density (densitometry) and specific gravity** of all materials
- b. **Granulometry** from 50nm to 5mm
- c. **Specific area** of powders and porous structures by BET by nitrogen absorption
- d. **Porosimetry** by nitrogen absorption
- e. **Viscosity** of glues, inks, adhesives, solutions etc.
- f. **Vacuum** resistance (self-crushing of foams etc.) to 0.1torr
- g. **Vibration** testing to 1000g
- h. Air and water **permeability** of all porous materials
- i. **Moisture absorption** of plastics, paper, card, wood, composites etc.
- j. **Thermogravimetry** of polymers and reactants
- k. **Metallurgical** examination with transmitted or reflected light to 1200X
- l. **Microstructural** assessment using Optical and Scanning Electron Microscopy (SEM)
- m. **Image analysis** of metallurgical surfaces
- n. **Transmission Electron Microscopy (TEM)**
- o. Determination of surface **emissivity** of all materials to 1000°C
- p. Determination of **colour and whiteness** of printed material

E. Other services

- a. Shaping by **hot pressing, extrusion and rolling** of plastics
- b. **Failure analysis** of materials and structures
- c. Precision **diamond cutting and polishing** of metals and ceramics
- d. **Autoclaving** of plastics etc. up to 200°C under vacuum or protective atmospheres
- e. **3D printing (SLA)**
- f. Thermal and structural analysis using **Finite Element Methods (FEM)**

Other measurements and tests may be possible – please contact us at

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