

Devoted to Community of Material Scientists
Achieving Excellence since 1978



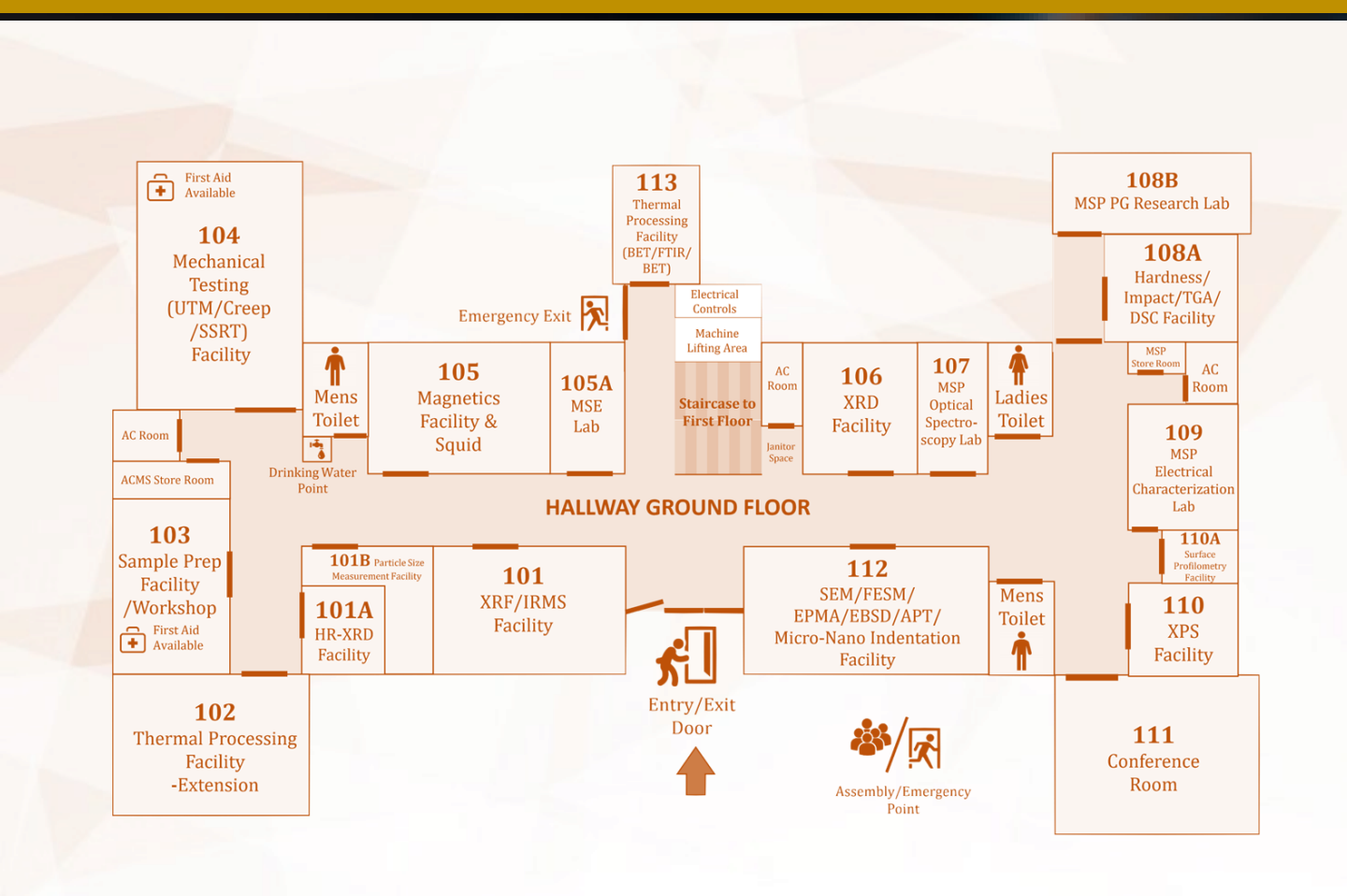
*Your One Stop Solution for all
Material Characterizations*

ACMS Guide

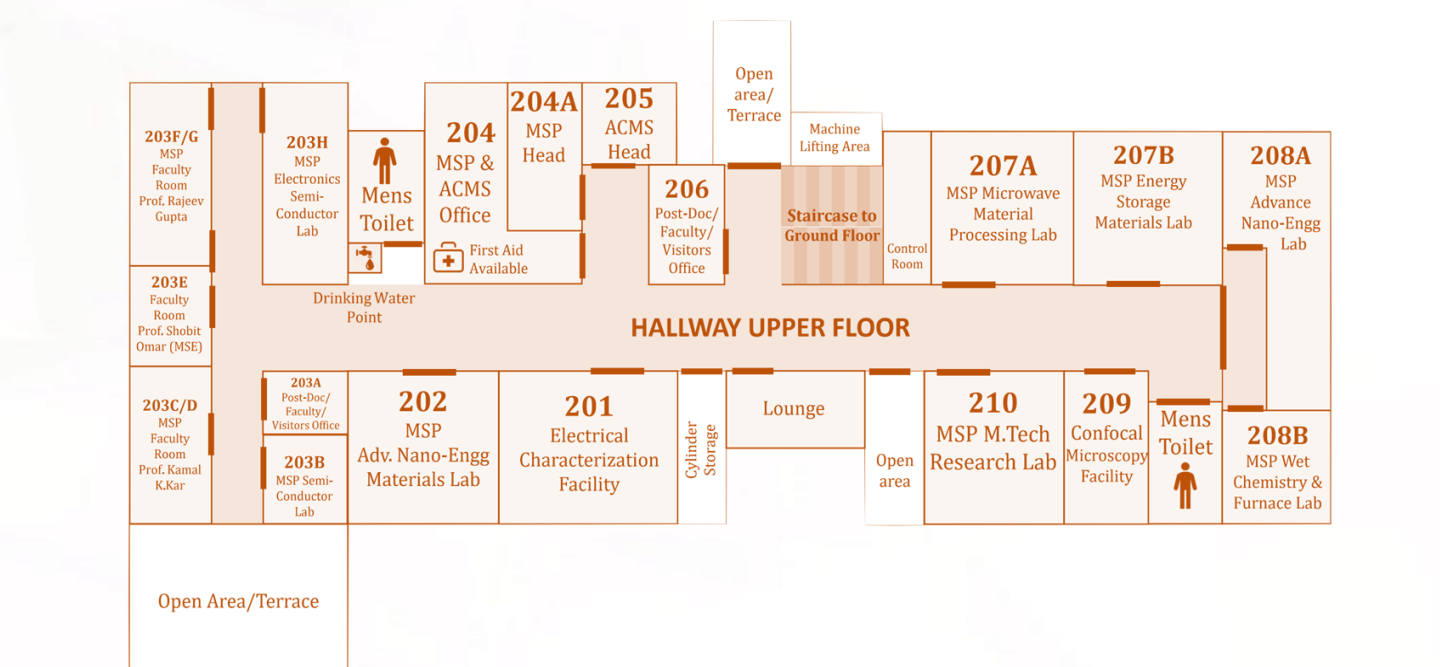
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LAYOUT OF ACMS

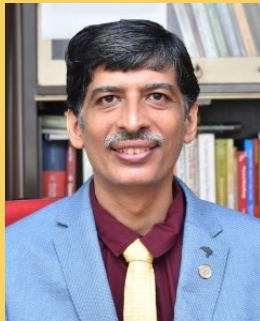


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UPPER FLOOR

MESSAGE FROM HEAD



Advanced Centre for Materials Science (ACMS) was established in the year 1978 as a central facility hosting state-of-the-art material characterization facilities. ACMS has been a leading one-stop place catering to in-house research scholars/faculty, defence labs, various colleges/universities and industries across the nation. The routine x-ray diffraction (XRD), scanning electron microscopy (SEM), and mechanical testing (indentation, tensile, compression, torsion, fatigue, creep, etc.) are among popular techniques, and are being extensively used by researchers. ACMS was revamped in the year 2014 adding new high-end equipment, like instrumented indenters (NI & MI), X-ray photoelectron spectroscopy (XPS), electron probe micro analyser (EPMA), high temperature X-ray diffraction (HT-XRD), field emission scanning electron microscopy (FE-SEM), near-field Scanning optical microscopy (NSOM), low- and high-temperature electrical measurements to name a few. In addition, mechanical testing equipment were retrofitted to make it encompass slow-strain rate and environment-controlled test conditions. Thermal treatment (furnaces) and characterization (Differential scanning calorimetry/ Thermogravimetric analysis), powder size (laser scattering) and surface area (BET & picnometry), optical surface profilometer, magnetic properties (vibrating sample magnetometer), and electrical property characterization (impedance measurement) have also added a lot of value to research output. The ACMS also houses live-cell imaging, superconducting quantum interference device (SQUID), X-ray fluorescence (XRF)/ Stable isotope ratio mass spectrometer (IRMS) and serves as a nodal point of National Facility for Atom Probe Tomography (NFAPT). ACMS not only has competent and trained staff handling the equipment in ACMS that keeps the health of equipment under check and provides accurate results, but also has faculty in-charge with rich experience on that equipment to provide consultancy/guidance to researchers/labs/industries towards exploring new dimensions in their analysis/research. With the hosted facilities included under I-STEM (Indian Science, Technology and Engineering facilities Map) to cater the entire nation, all researchers are invited to utilize these high-end facilities to its full potential and live the experience of a high-quality research at ACMS, IIT Kanpur!

- **Prof. Kantesh Balani**
Head, ACMS



LIST OF MATERIAL CHARACTERIZATION FACILITIES

AVAILABLE AT ACMS

❖ Mechanical Properties Characterization

- Tensile/Compression/3pt- 4pt Bending/Torsion
- Cyclic/Fatigue /Random Spectra
- Fracture Toughness(J1C/K1C)
- Creep/Slow Strain Rate
- Tensile at high temp (1600 °C)
- Tensile at low temp (-20 °C)
- Tensile submerged in salt solution
- Indentation (Macro/Micro/Nano)
- Impact (Charpy)
- Wear Test

❖ Microscopic Fractographical Characterization

- EPMA
- W-SEM
- FEI
- FESM
- Optical Microscopy

❖ Surface Texture Characterization

- X-ray Diffractometry (Two circle)
- X-ray Diffractometry (Four circle)
- Surface Profilometry

❖ Thermal Analysis

- BET Surface Analyzer
- TGA/DSC
- OES

❖ Thermal Processing

- Ball-milling (Traditional)
- Ultra-sonic Cleaner
- RFM Wear tester
- Vacuum sealing

❖ Magnetic Property Characterization

- VSM (Magnetic strength measurement at room temp)
- SQUID (Cryogenic magnetic strength measurement)

❖ Electrical Characterization

- Electrical Characterization using Probe Station (Cryogenic [10-350 K] & High Temp [300 °C])
- Semi-Conductor Parameter Analysis
- Hall-Effect Measurement (Room Temp / Cryostat with electro-magnet)
- Sheet Resistance Measurement
- Thermoelectric Measurement (See-back Coefficient)
- Piezo/Ferro/Pyro Material Characterization
- Plasma Sputter Coating
- Near-Field Scanning Optical Microscopy
- Probostat (LCR / Solotron / Probostat)

❖ Live Cell Imaging Facility

- Advanced High Sensitive Spectral Confocal and Multiphoton Microscopy for Live Cell Imaging

❖ Spectroscopy for Material Analysis

- X-Ray Fluorescence Spectroscopy (XRF)
- Stable Isotope Ratio Mass Spectroscopy (IRMS)

❖ Sample Preparation Facility

- Lathe Turning
- Diamond Wire Saw
- Drilling/Grinding
- Vibrator Polishing



LABS & INSTRUMENTS SETUP AT ACMS

	Lab Name	Equipment in the Lab
1	Electron Microscopy Lab	•Scanning Electron Microscope (FE-SEM) with in-situ Tensile Testing & Electron Backscatter Diffraction (EBSD), •Tungsten-Electron Microscope(W-SEM), FEI-SEM with integral EDS detector, •Electron Probe Micro-Analyser (EPMA),
2	XRD Lab	•PANalytical X-Ray Diffractometer (XRD), •Two Circle Diffractometer, •Four Circle Diffractometer
3	Thermal Processing Lab	•BET Surface Area Analyzer, •Optical Emission Spectroscopy, •Furnaces, •Ball-milling
4	Thermal Analysis Lab	•Thermo-Gravimetric analyzer (TGA), •Differential Scanning Calorimetry (DSC),
5	Mechanical Testing Lab	•Instron-1195 UTM, •MTS610-UTM, •BiSS 100 KN Hydraulic UTM, •ATTS Axial Torsion System, •Creep Station, •Instrumented Charpy Impact, •Slow Strain Rate Testing System (SSRT),
6	Indentation & Profilometry Lab	•Universal Hardness Tester, •Instrumented Micro Indentator, •Instrumented Nano Indentator, •3D Surface Profilometer
7	Electrical Characterization Lab	•Probe Station (Cryogenic /Heating), •Semiconductor Parameter Analyzer, •Hall Effect, •Sheet Resistance, •Thermoelectric Characterization, •Piezo, Ferro, Pyro-Electric materials characterization, •Closed Cycle Cryostat, •Near Field Scanning Optical Microscope (NSOM), •Impedance Analyzer, •Photostat High Temp
8	Magnetics Lab	•Vibrating Sample Magnetometer (VSM), •Superconducting Quantum Interference Device (SQUID) Magnetometer
9	XPS Lab	•X-ray Photoelectron Spectroscopy (XPS) Facility & with Auger Electron Spectroscopy (AES)
10	Mass Spectroscopy (XRF/IRMS) Lab	•X-Ray Fluorescence Spectrometer, •Stable Isotope Ratio Mass Spectrometer(IRMS), •Glass Bead Making Machine
11	Live-Cell Imaging Lab	•Advanced Spectral Confocal and Multiphoton Microscope
12	Sample Preparation Lab /Workshop	•Vibratory Polisher, •Diamond Wire Saw, •Wire Electrical Discharge Machining (W-EDM), •Lathe
13	NFAPT	•National Facility for Atomic Probe Tomography (NFAPT)
14	Particle Size Analyzer	•Particle Size Analyzer



1. ELECTRON-MICROSCOPY LAB

1.1 Electron Probe Micro-analyser (EPMA)



Model: JEOL JXA-8230

This is a W/LaB₆ based EPMA with four channels for WDS analysis along with an EDS detector. LaB₆ gun provides combination of beam stability and resolution. EPMA is the most accurate technique for micro-composition analysis. Both standard and standardless analyses are possible in point, line or area scan modes. Elemental mapping with high resolution can be done with both WDS and EDS techniques. Quantitative analysis of all elements from B to U is possible.

Specifications:

- Range of elements: Boron (Z=5) to Uranium (Z=92)
- Accelerating voltage: 0.2 to 30kV
- Probe current : 10 nA to 500 nA
- Probe current stability: +/-0.05%/h
- SE Image Resolution: 5 nm
- WDS wavelength detection: 0.087 to 9.3 nm
- 4 channel fast analysis for multicomponent alloys
- Elemental mapping by EDS

1.2 Tungsten Electron Microscope (W-SEM)

This is a compact SEM for the quick image analysis with high resolution and compositional information. The integral EDS detector can be used for micro-compositional analysis.

Specifications:

- BSE Resolution: 5 nm at 20kV
- Magnification: 5x to 300000x
- Accelerating voltage: 0.5 to 20kV
- Automatic SEM condition set-up based on sample type
- Elemental mapping by EDS



Model: JSM-6010LA; JEOL

1.3 Tungsten Electron Microscope (FEI SEM)



Model: Quanta 200

This is a state-of-the-art SEM from FEI for extensive image analysis with high resolution and compositional information. This is a well-suited for variety of materials for microscopy.

Specifications:

- SE Resolution better than 2.0 nm at 20kV
- Magnification: 5x to 500,000x
- Supports biological and polymeric samples
- Best for diversified specimens

1.4 Electron Microscopy Accessories



Carbon Sputter Coating Unit
Model: JEC 560; JEOL

Gold Sputter Coating Unit
Model: JEC 3000; JEOL

Plasma Cleaner
Model: JEOL EC-52000IC

1.5 Field Emission FE-SEM with In-Situ Tensile Testing and EBSD

The high resolution secondary as well as backscattered electron images shall now be possible with the new addition of the FESEM. The FESEM is equipped with SE, BSE and EDS detector in addition to EBSD, *in-situ* tensile stage module and a heating stage. This facility is used in two modes: a) Imaging and b) Orientation Imaging Microscopy [OIM]. With EBSD based Orientation Indexing Microscopy (OIM), the equipment has an unmatched capability of micro-texture analysis. The tensile stage makes it possible to carry out *in-situ* tensile testing and the heating stage can be used to take the images at up to 500 °C.



Model: JSM-7100F; JEOL

Specifications:

- SE Resolution: 3nm at 15kV/5nA
- Magnification: 10x to 1000000x
- Accelerating Voltage: 0.5 to 30kV
- Elemental mapping by EDS
- Micro-texture analysis by EBSD with smallest step size of 10 nm possible
- Combinatorial EBSD and EDS
- GATAN Tensile stage of 5kN capacity and temperature of 500 degree Celsius

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2. X-RAY DIFFRACTION LAB

2.1 Panalytical XRD



Model: Panalytical

Panalytical XPert for ultra-fast X-ray diffraction on bulk and powder samples using line detector (with in-situ high temperature stage, limited Small Angle X-Ray Scattering and thin film capability). It has wide application range like Semiconductors and single crystal wafers, Polycrystalline solids and thin films, nanomaterials and amorphous layers

Specifications:

- Optics :
 - Detector : PiXcel^{1D}
 - Filter : Beta Filter
 - Attenuator : Ni foil
- Tube :
 - Target : Cu/Co/Cr
 - Focus : Long line, 1.8-10.4°
- Reflection transmission spinner : Range (N x (0-360°))

Applications :

- Powder : 3° - 130°, Scan axis: 2 θ - ω , 2 θ , ω -2 θ
- Thin film : $\omega > 0.5$
- High temperature : Ambient to 1400°C,
Vacuum (10⁻⁴ mbar), Purging with N₂
- SAXS : Range 0-5 °, 1-100 nm particle and pore size distribution

2.2 Two Circle Diffractometer

This two circle benchtop diffractometer is used for routine qualitative and quantitative phase analysis of poly-crystalline materials like phase determination, precise lattice parameter determination, crystallite size and strain determination.

Specifications:

- Optics :
 - Divergence slit : Fixed
 - Scattering/Receiving slit : Fixed
 - Filter : K β foil filter
 - Soller Slit: 5.0° or 2.5°
- Goniometer :
 - Type : Vertical
 - Radius : 150mm
- Detector : Scintillation counter (NaI scintillator (T1))

Applications :

- Types of Test : Powder and bulk Samples
- Range : 2 θ measuring range: 3 to 140° (maximum)



Model: Rigaku Miniflex 600

2.3 Four Circle Diffractometer

The facility is equipped with a Rigaku Ultima Four circle diffractometer capable of determining pole figures for bulk as well as thin film samples. In addition, the diffractometer can carry out residual stress measurement on bulk and thin film samples. Detailed analysis of thin films using rocking curves and combinatorial analysis of stress and orientation along with quality of epitaxial thin films can be obtained using reciprocal space map. In addition, different sources like copper and cobalt are available which ensure that different class of materials from iron and steel, titanium and its alloys with Cobalt source and other non-ferrous materials like aluminium, copper and their alloys can be studied without fluorescence using a Copper source. The diffractometer is equipped with state of the art optics to enable above mentioned modes of measurement that cover almost all the texture and stress measurement needs of bulk and thin film samples. It can work on a range of temperature up to 1400°C.



Model: Rigaku Ultima

Specifications:

- Optics :
 - Divergence slit : Automatic variable
 - Scattering /Receiving slit : Automatic variable
 - Optics alignment : Automatic alignment
 - Monochromator : Dual position graphite diffracted beam monochromator for Cu
- Goniometer :
 - Scanning mode : θ_s/θ_d coupled / θ_s , θ_d independent
 - 2θ measuring range : 3 to 140°
- X-ray Target : Cu/Co/Cr

Application:

- Bulk Texture Analysis :
 - Range:- α -axis(tilt): 15 ° to 90 °,
 - β -axis(in Plane rotation): 360 °,
 - γ -axis(Oscillation axis): -5 mm to 5 mm
- Residual Analysis :
 - Range:- Up to 140 °, from light alloy and stainless steel to ceramics
- Powder and Bulk sample Analysis :
 - Range:- 2θ measuring range: 3 to 140° (maximum)
 - Goniometer radius: 285 mm

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3. THERMAL PROCESSING LAB

3.1 Optical Emission Spectroscopy (OES)



Model: Spectromaxx

This arc/spark OES analyser is widely used to determine the elemental composition of a broad range of metals (Lithium to Uranium) that uses the light emitted (arc/spark) on an excited element falling in range of visible emission spectrum. It can also determine the concentration of the considered element. It is equipped to achieve fast, accurate elemental analysis precisely tuned for material control and foundry applications

3.2 Ball Milling

The facilities of ball milling can be used for mechanically mixing the powder particles or for minimising the size of powder particles. It grinds and blends the materials for use in mineral dressing processes, paints, pyrotechnics, ceramics and selective laser sintering. It contains the container with powder and balls in it to create planetary motion, where balls while motion crush the powder particles. It has controlled movement of balls for the set time duration along with coolant to maintain temperature and counter-weights to balance.



3.3 BET Surface Area Analyzer

Physisorption techniques are used to determine the surface area and pore structure. The system characterizes samples with nitrogen gas as the standard adsorptive gas and has the versatility for analyses of materials with low surface areas using Krypton and other adsorptive gases, micropore analyses (pore radii between 5 and 15 Angstroms). The system is capable to perform automatic single-point and multi-point BET surface area, Langmuir surface area, full adsorption and desorption isotherms, and pore size and pore volume distribution. It is also equipped with chemisorption analysis, and also, thermal programming oxidation, reduction, and desorption. Typical values of the BET area for porous materials vary between 50 to 2000 m²/g. Average pore-width of the activated carbon fibres is usually in the range between 2 to 50 nm, whereas that of nanofibers is less than 2 nm.



Model: Autosorb I; Quatachrome Corp

3.4 Thermal Furnaces



These furnaces are essentially a thermal enclosure employed to process raw materials at high temperatures both in solid state and liquid state. Several industries like iron and steel making, non ferrous metals production, glass making, ceramic processing, etc. employ furnace. The primary objectives is to utilize heat efficiently to minimise the losses and to handle different phases moving at different rate, time and temperatures such that erosion and corrosion of the refractory are minimum.

Type of furnace: Tubular and Box Furnace
Temp. Range: up to 1600 °C

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4. THERMAL ANALYSIS LAB

4.1 High Temperature Thermo-gravimetric Analyzer (TGA)



Model: Hysitron STA 8000
Perkin Elmer Ltd

Thermal analysis is regularly done on a range of crystalline and non-crystalline materials to understand the kinetics and thermodynamics of various phase transformations. Advantage of thermal analysis is that it can be carried out even on non-crystalline, such as polymers as well as inorganic materials. Differential scanning calorimetry (DSC) measures change of heat in sample with reference to a standard reference and hence we get a plot of differential heat as a function of temperature. Any transformation is recorded as a peak in the plot. Various attributes such as the amount of heat, start temperature for transformation, activation energy, etc can be determined from such plots.

Specifications:

- Calorimetric sensitivity of $0.2\mu\text{W}$ allows capturing faintest of transformation where stored energy is small as 1J/gm
- High accuracy of heat flow can be obtained (0.2%), High precision of heat flow measurement (0.03%)
- Dynamic range of calorimeter (up to 1300mW)
- Very large range of temperature can be explored (RT to 995°C), high accuracy of temperature measurement (0.050°C), and high precision of temperature measurement (0.0080°C)
- Fine resolution of weight balance ($0.2\mu\text{g}$)
- High heating range and cooling rates

Application:

- Thermal stability of severely deformed materials
- Thermal degradation of high temperature materials
- Glass transition and melting point of various bio-polymers

4.2 Differential Scanning Calorimetry (DSC)



Model: PerkinElmer

This DSC has double furnace technology, which directly measures the heat flow difference between two independent furnaces. This design gives higher accuracy and sensitivity for even your most demanding applications. It has calorimetric dynamic range of $\pm 1300\text{ mW}$ with accuracy of $<\pm 0.2\%$ and precision of $<\pm 0.03\%$ and sensitivity of $0.2\mu\text{W}$. It come with controlled heating and cooling rates with temperature performance range of -180°C to 750°C .

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5. MECHANICAL TESTING LAB

5.1 Instron-1195

Instron-1195 is a retro-fitted screw driven universal testing machine (UTM) equipped with modern day compact controller satisfying most of the basic mechanical testing requirements.

Specifications:

- Max. Load Capacity: 100 kN (tuned up to 50kN)
- Min. Load: 1 g and 1 N
- Test Type: Tensile, Compression, 3-pt/4-pt Bend, Loading-Unloading.
- Load Cells: Tensile 'or' Compression: 100 kN, 500 N, 2 kN, Tensile only: 50 gm
- Sample Type: Round, Flat, Sheet, Cylindrical
- Crosshead Speed: Max: 40 mm/min
Min: 0.005 mm/min
- Crosshead Displacement: 700 mm
- Extensometer: (Travel) 25mm, 2.5mm, 0.5mm



5.2 MTS 610



MTS-610 is another retro-fitted hydraulic universal testing machine which is used for testing at higher speed. The machine is also equipped with furnace is suitable for testing at high temperature test conditions [1000 °C].

Specifications:

- Load Capacity: 100 KN
- Furnace Type: Chamber Furnace
- Maximum Furnace Temperature: 1000 degree Celsius
- Load Cells: 100 KN, 10 KN
- Sample Type: Round, Flat, Sheet, Cylindrical, Threaded
- Crosshead Speed: Max: 70 mm/sec and Min: 0.001 mm/min
- Crosshead Displacement: 160 mm

5.3 BiSS 100 KN

BiSS-100KN UTM is a hydraulic UTM preferred by the facility users. It can be used for all the static and dynamic mechanical testing. All Fatigue tests are performed on this machine beside other tests. The machine is also equipped with an add-on setup of environmental chamber setup to control the humidity and temperature of the environment.

Specifications:

- Load Capacity: 100 kN/5kN
- Test Type: Tensile, Compression, 3-pt/4-pt Bend, Loading-Unloading, Fatigue, VAFCP, J1C/K1C & DIC
- Sample Type: Round, Flat, Sheet, Cylindrical, CTOD
- Crosshead Speed: Max: 60 mm/s and Min: 0.001 mm/min
- Crosshead Displacement: 160 mm
- Extensometer: 25 gage (travel 2.5 mm & 0.5 mm), COD: 5 mm



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4. BiSS Axial Torsion Test System (ATTS)



ATTS is another hydraulic UTM with an additional capacity to apply torque on samples simultaneously along with the axial loading. The machine is also equipped with furnace which made is suitable for testing at high temperature test conditions.

Specifications:

- Maximum Load Capacity: 100 kN (Axial) & 500 Nm (Torque)
- Types of Sample can be Tested: Flat, Sheet, Cylindrical
- Crosshead Speed: Max: 70 mm/sec and Min: 0.001 mm/min
- Maximum Crosshead Displacement: 160 mm
- Heating Arrangement: Induction Furnace (max temp: 1000 °C)
- Heating Speed: Variable heating speed up to 3 kW (min: 1 °C/s)

5.5 Creep Testing Station

This Creep station has two electrically actuated units with two dedicated furnaces which can be controlled simultaneously at different stress and temperature levels with the capability to carry out constant load and constant strain tests in tension.

Specifications:

- Maximum Load Capacity: 50 kN
- Maximum Furnace Temperature: 1000 °C & 1600 °C
- Sample Type: Cylindrical Threaded (M10, M12, M16)
- & sheet (2mm thickness)
- Crosshead Speed: Max: 10^{-2} /s and Min: 10^{-7} /s
- Maximum Crosshead Displacement: 160 mm



5.6 Slow Strain Rate Stress Corrosion Station

The two SSRT stations are to fulfil the need of testing at slow strain rate in air or in any corrosive medium. Both the systems comes with same configuration but with different orientation for specimen mounting, one is vertically mounted whereas another is horizontally mounted. These electrically actuated machines are perfect for a precise slow displacement of test specimen to generate slow stress over period of time. Both the units comes with dedicated liquid bath chambers.

Specifications:

- Maximum Load Capacity: 50 kN
- Available Load Cells: 50 kN & 5 kN
- Sample Type: Pin-loaded Flat samples, Cylindrical Threaded (M8, M10, M12)
- Crosshead Speed (Strain Rate): Max: 10^{-2} /s
Min: 10^{-7} /s
- Maximum Crosshead Displacement: 160 mm
- Type of Test Control: Stroke and Load



5.7 ZWICK INSTRUMENTED CHARPY IMPACT TESTER

For impact testing of test specimens with and without notch, an automated impact tester is installed with temperature bath unit filled with silicon oil for study of ductile to brittle transition at low temperature.

Specifications:

- Maximum Applied Energy: 150 J
- Maximum Specimen Length: 70 mm
- Liquid Bath temperature Range: -50 °C to 30 °C



6.1 Tribo-Indenter Nano-Mechanical Testing Instrument

Nano Indentation is an advanced technique that can be used to measure mechanical properties at nano-scale such as modulus, hardness, stiffness of materials in different shapes, sizes and scales. The Nano-Mechanical Testing System with modulus mapping capability can perform Nanotribology studies e.g. scratching at different loads, wear volume, coefficient of friction. It can analyse Assay of coating lifetime. Loss and storage modules and damping measurement can also be performed. Indent and wear track imaging can be captured simultaneously.



Model: Hysitron TI 750L

Specifications:

- Load Capacity: 10 μ N to 10mN for Indentation, 10 μ N to 1.2mN for Scratch
- Type of tests can be performed: Indentation, Scratch, Modulus Mapping, in-situ SPM Imaging
- Type of material can be tested: Metals, Porcelains, Ceramics, Glasses, Polymers, Composite, Biomaterials etc.
- Temperature range: RT to 400°C
- Transducer available: DMA-for Indentation and Modulus Mapping, 2D- for Indentation and Scratch
- Indenter Tips: Conical-100 μ m, 10 μ m 90° and Fluid Cell 50 μ m 90°, Berkovich—3Side Pyramidal, NorthStar- 40nM 90° Cube Corner, High load Berkovich, 90° Cube Corner, High Temperature -Eclipse
- Sample Type: Coated, Round, Flat (rough and polished)

6.2 Instrumented Micro Indentation Tester

Using this Micro-Hardness Tester one can ideally determine the mechanical properties of thin films, coatings, or substrates such as hardness and elastic modulus. The instruments handle almost any type of material, whether soft, hard, brittle, or ductile. Also capable to conduct creep, fatigue, and stress-strain studies on surfaces in the nanometre range.



Model: CSM International

Specifications:

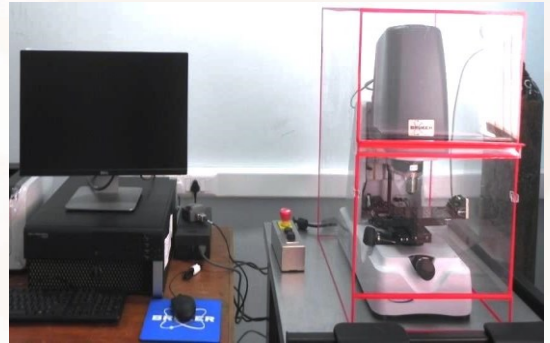
- Type of tests can be performed: Indentation, Scratch
- Available indenters: Vickers, Knoop, Rockwell, High temperature Vickers
- Temperature range: RT to 850°C
- Load for Indentation: (i) Fine range : 50 mN - 10 N and (ii) Large range: 50 mN - 30 N
- Loading Rate for Indentation: 10 [mN/min] - 300 [N/min]
- Depth: (i) Fine range: 100 μ m and (ii) Large range: 1000 μ m
- Load for Scratch: 0- 30N
- Loading rate for scratch: 0 - 300 N/min
- Scratch Speed: 0.4 - 600 mm/min
- Types of materials can be tested: Metal, Porcelain, Ceramic, Glass, Polymer, Composite, etc.
- Types of sample: Coated, Round, Flat and polished

6.3 Optical Profilometer

Optical Profilometer is designed for surface metrology performance which can be used to measure the roughness & profile of a surface. It comes with capabilities to measure exceptional roughness, thickness step height and other 2D/3D measurement along with high-resolution imaging. It comes with two optical modes, (i) Vertical Scanning Interferometry(VSI) and (ii) Phase-Shifting Interferometry (PSI).

Specifications:

- Max. Scan Range: Up to 10mm
- Vertical Resolution: <0.1nm
- Max. Sample Slope: Up to 40° (shiny surfaces); Up to 87° (rough surfaces)
- Sample Height: Up to 100mm (4in.)
- Sample size: up to 4 inch dia or square
- XY Sample Stage: 150mm (6 in.) manual or optional motorized stage
- Z Focusing: 100mm (4 in.) manual or motorized option
- Optical Metrology: Module Patented dual-LED illumination; Single-objective adapter; Optional automated turret; Optional manual or motorized discrete modules
- Objectives: 2.5X, 20x, 50x; Zoom: 0.55x, 2x



Model: Bruker GTK0X

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6.4 Universal Hardness Tester

This universal hardness tester is suitable for all basic hardness procedures like Rockwell, Brinell, Vickers, and Knoop, also ball and indentation hardness testing for thermoplastics.

Specifications:

- Hardness scales: Brinell, Vickers, Rockwell, Super-Rockwell, Knoop, Vickers depth (HVT), Brinell depth (HBT), Plastic
- Test loads/force: 1 kgf/9.8 N/2.2 lbf – 250 kgf/2.45 kN/551 lbf
- Load duration: 0.1 – 255 sec
- Specimen Dimension: max. height 320 mm, max. width 220 mm



Model: Tinius Olsen FH-10

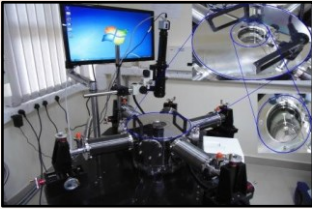
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7. ELECTRICAL CHARACTERIZATIONS LAB

7.1 CRYOGENIC PROBE STATION



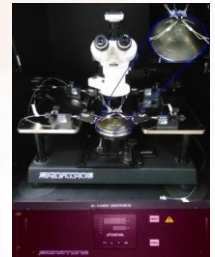
Specifications:

- Key performance specifications
- a) Temperature range 10K - 350K
- b) Four micromanipulators with triaxial cables
- c) One optical arm for LASER excitation of samples (User provided)
- d) Maximum sample size 1-inch x 1-inch

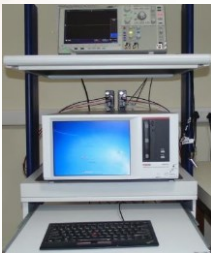
7.2 PROBE STATION WITH HEATING STAGE

A platform for measurement of electrical characteristics with help of Semiconductor Parameter Analyzer from ambient to 300°C.

- Four micromanipulators with coaxial cables.
- Two micromanipulators with triaxial cables.
- Temperature range ambient temperature to 300°C
- Maximum sample size 12.7 mm x 12.7 mm
- Provision for chuck bias



7.3 SEMICONDUCTOR PARAMETER ANALYZER



Specifications:

- DC Current-Voltage measurement:
 - Current source/measure from 1 pA to 1 Amp
 - Voltage source/measure from 210 mV to 200 Volt
- CV measurement: Frequency = 1 kHz to 10 Mhz and 10 mHz to 10 Hz
- Pulse IV: Frequency range 1 Hz to 50 MHz; time resolution for measurement = 10 nano-sec

7.4 OSCILLOSCOPE

Specifications:

- 1 GHz, 500 MHz, 350 MHz, and 100 MHz bandwidth models
- 2 and 4 analog channel models
- Up to 5 GS/s sample rate on all channels
- Up to 20 mega-point record length on all channels
- >50,000 wfm/s maximum waveform capture rate
- Standard passive voltage probes with less than 4 pF capacitive loading and 500 MHz or 1 GHz analog bandwidth
- Suite of advanced triggers



7.5 SHEET RESISTANCE MEASUREMENT SYSTEM - PRO4



Measurement capability:

- The resistivity measurements of the sheet and bulk samples.
- Quick measurement of sheet resistance of thin-films, semiconductor wafer.

7.6 TABLE TOP HALL EFFECT MEASUREMENT SYSTEM

- 1) Measurement capability: Resistivity, type of conductivity, mobility and doping level in a material.
- 2) Magnetic-field strength: Magnetic field strength 0.55 ± 0.03 Tesla (permanent magnet)
- 3) Sample Size:

- I. Sample holder model no. - SH80350K
 - I. Temperature: 80 K - 350 K
 - II. Maximum sample thickness: Less than 2 mm
 - III. Maximum sample size: 10 mm x 10 mm
- II. Sample holder model no. - SPCB-21
 - I. Only for room temperature measurement
 - II. Maximum sample thickness: Less than 2 mm
 - III. Maximum sample size: 15 mm x 15 mm



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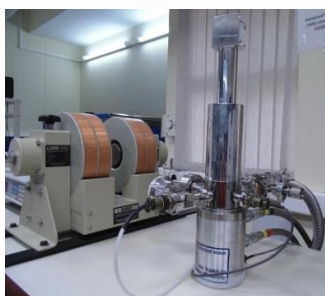
7.7 THERMOELECTRIC CHARACTERIZATION SYSTEM



Thermoelectric characterization system for bulk and thin film samples.

- 1) Temperature Range: Thermoelectric characterization in range of 50°C to 1000°C under helium gas.
- 2) Type and dimensions of samples allowed:
 - I. Pellet with radially two ends polished flat as shown in the schematic below.
 - II. Rectangular bar
Note: For 1) and 2): The surface of sample making contact with the electrodes would be in between 2×2 to 4×4 mm². The distance between the two electrodes could be in the range of 5 to 22 mm only.
 - III. Cylindrical bar: The diameter could be in the 2 - 4 mm range and the length should be in the range of 5 to 22 mm only.
 - IV. Thin-film: Use the special holder that has been provided for this purpose.

7.8 CLOSED CYCLE CRYOSTAT WITH ELECTRO-MAGNET



Advanced Research Systems (ARS) closed cycle cryostat CS202AI-DMX-1SS with GMW 5403 Electromagnet Magnetic Field strength = 0.6 T

Measurement:

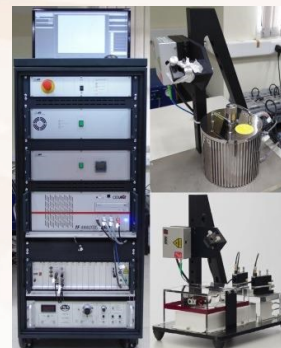
- Magneto resistance measurement/Hall effect measurement
- Hall measurements from 10K to 800K.
- Magnetic field strength = 0.6T

7.9 PIEZO/FERRO/PYRO ELECTRIC MATERIALS CHARACTERIZATION

The instrument can perform measurement like: 1. Dynamic Hysteresis Measurement (DHM), 2. Pulse Measurement (PM), 3. Static Hysteresis Measurement (SHM), 4. Leakage Current Measurement (LM), 5. Fatigue Measurement (FM), 6. Retention Measurement (RM), 7. Imprint Measurement (IM).

MEASUREMENT VARIABLES:

1. For piezo sample holder unit:
 - Sample diameter: 3 mm to 25 mm
 - Sample thickness: 0.1 mm to 5 mm
 - Internal heater temperature range: 20 to 800 °C
 - Use of silicon oil possible to increase the flash-over voltage.
- 2 For thin film sample holder unit:
 - Maximum sample size allowed: 25 mm x 25 mm
 - Sample thickness: 0.1 mm to 10 mm
 - Temperature range: 20 to 250 °C



7.10 PLASMA SPUTTER COATER



Specifications:

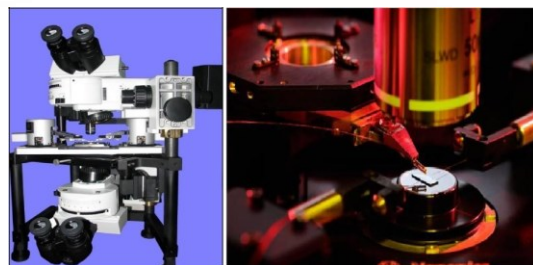
Metal deposition on the sample back side for better electrical contact during measurement.

7.11 NEAR FIELD SCANNING OPTICAL MICROSCOPE (NSOM)

Multimodal NSOM provides simultaneous measurements of the topography and direct correlation between surface nano-features with resolution less than 50 nm and optical/electronic properties

Mode of Operations

- Near-field scanning optical microscopy
- Reflection NSOM (NSOM)
- Collection Mode nanostructures with resolution of 10-20 nm
- Transmission Mode in lateral dimensions and 2-5 nm in vertical dimensions.
- Apertureless NSOM
- Near-field Illumination & Near-field Scattering with Multiple AFM/NSOM probes



Specifications:

- Multimodal NSOM provides unique opportunity to conduct simultaneously various electrical and optical characterizations for nano structured materials like nanowires, nano-particles etc.
- Direct mapping of photocurrent for solar cells.
- Imaging optoelectronic devices & films: A combination of emission and bias modulation for LED and photovoltaic devices.
- Single-Molecule Spectroscopy (SMS) and Imaging
- Surface plasmon polaritons for chemical and bio sensing devices.
- Crystallographic defects at the nanometer scale

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7.12 IMPEDANCE ANALYZER

Major applications of this instrument are Corrosion studies, Battery research and fuel cells, Solar cells, LCDs, Bio-materials, Ceramics, Composites, Electronic component development.

Specifications:

- Wide frequency range: Spanning 10 μHz to 32 MHz with 0.015ppm resolution, this analyser provides excellent coverage for virtually all chemical and molecular mechanisms.
- Noise free analysis:
- Frequency resolution: 1 in 65 million (0.015 ppm)
- 0.1%, 0.1° accuracy
- Resolution to 0.001 dB, 0.01°
- Measures impedances >100 MO
- 2-, 3- and 4- terminal measurement configurations
- Polarization voltage up to $\pm 40.95\text{ V}$



7.13 LCR METER

Specifications:

1. Measurement Capabilities

- 14 parameters can be measured- $|Z|$, $|Y|$, R_p , R_s , G , X , B , L_p , L_s , C_p , C_s , D ($\tan d$) and Q
- Inductance of winding, floating capacitance
- Characteristics at operating frequency and low frequency resistance components
- Four simultaneous measurement parameters at a time
- Inductance (L) and DC resistance (DCR) can be measured

2. Electronic Features:

- High frequency range (42 Hz to 5 MHz)
- High resolution and high accuracy ($\pm 0.08\%$)
- Fastest measurement time 5 ms



7.14 HIGH-TEMPERATURE PROBOSTAT



Norecs High Temp Probostat

Specifications:

- Conductivity vs. T , pO_2 , pH_2O etc.
- DC, AC impedance spectroscopy
- Dielectric properties loss etc.
- 2 and 4 electrodes
- Ionic transport number
- I-V characteristics
- Fuel cell components (Electrolyte, Anode/Cathode) and single cell testing



GEN'AIR Oxygen Pump Gauge

Specifications:

- Generate oxygen partial pressure between 0.25 and 10-35 atm
- Use of different kinds of carrier gases, at various concentrations such as Ar, H_2 , O_2 , CO_2 , CO, Air etc.
- Low gas consumption: necessary flow 1 to 12 l/h
- Control of the applied voltage and current
- 0 - 20 mA or 4 - 20 mA, linear, with galvanic insulation RS232 port

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8. MAGNETIC PROPERTIES LAB

8.1 Vibrating Sample Magnetometer (VSM)

Virtually any type of magnetic material can be characterized on the EV7 VSM systems like Solids, liquids, powders, thin films, rocks etc. This is unique in its combination of a very high maximum field for a compact system combined with unrivalled low field measurement performance.

Specifications:

- Supports all known types of magnetic measurements such as Hysteresis and minor loops, IRM and DCD Remanence Loops, as well as Angular and AC Remanence Loops, and Time decay measurements.
- Has lowest noise at any gap, 0.5 micro-emu and below 0.1 micro-emu at a usable sample space of 5 mm.
- Dynamic range of magnetic moment from 0.1 μ -emu to 100 emu.



Model: Microsense EV7

8.2 SQUID Facility

The superconducting quantum interference device (SQUID) magnetometer is one of the most effective and sensitive ways of measuring magnetic properties. In particular, it is the only method which allows to directly determine the overall magnetic moment of a sample in absolute units. SQUID consists of two superconductors separated by thin insulating layers to form two parallel Josephson junctions.

Specifications:

- Temperature range of measurement: 4-300 K and 300-700 K (needs oven insert)
- Range of magnetic field: up to 6.5 Tesla
- Types of measurements:
- DC- measurement (M-T, M-H)
- AC measurement (χ' and χ''), Frequency range: (0-3 KHz)



Model: SQUID

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9. SURFACE CHARACTERIZATION (XPS) LAB

9.1 X-ray Photoelectron Spectroscopy (XPS) with Auger Electron Spectroscopy (AES)



Model: PHI 5000 Versa Prob II, FEI Inc

The surface characterization Lab offers a high-end dedicated X-ray Photo-Electron Spectroscopy (XPS) facility along with Auger Electron Spectroscopy (AES) module and C60 sputter gun. XPS is a spectroscopic technique to quantitatively measure the elemental compositions and chemical and electronic states of the elements of a material, including their bond energy. It has high sensitivity for micro area spectroscopy with X-ray spot sizes of $< 10 \mu\text{m}$ to $200 \mu\text{m}$. It preform for the spot sizes: survey spectra, multi region high resolution spectra, sputter depth profiling, angle dependent depth profiling, line scans, and maps. Chemical state maps are created by scanning the x-ray beam pixel by pixel over the defined area with user adjust dimensions of the mapped area, pixel density, and spot size. Optional C60 sputter ion gun to sputter clean polymer surfaces without causing significant chemical damage. It has possibility of thin film analysis with significantly less chemical damage than would be expected when using an inert gas ion beam such as argon for various sophisticated materials.

Specifications:

- X-ray setting (max.): (i) Size of beam : $200 \mu\text{m}$, (ii) Power : 100 W, (iii) Voltage : 20 KV
- Pass Energy : 2.95 eV to 187.85 eV
- Time per step : 10 ms to 1000 ms
- Step Size : 0.025 eV to 0.800 eV
- Anode material: Al $K\alpha$
- Max. Binding Energy : up to 1400 eV

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10. MASS SPECTROMETRY (XRF/IRMS) LAB

10.1 X-Ray Fluorescence Spectrometer



Model: Rigaku Corporation, Japan

Rigaku made WD-XRF Machine (power: - 4 kW, 60 kV-150 mA) is used for detecting the elements. It is a non-destructive analysis technique for the Major oxides and Trace elements present in the sample with minimal sample preparation requirement. It can cover elements from Beryllium to Uranium. The concentration ranges go from 1 ppm to 100 wt%. Analysis can be done on pressed powder pellets or Glass beads (ranging from 10mm diameter to 30 mm diameter) made from fine powder (particle size-50 μ m).

Application: Basic application is to quantify the elements in metals & alloys, Geological samples, Chemicals (Raw & prepared), Filter samples, thin films, Ceramics etc.

10.2 Claisse M4 Glass Bead Making Machine

Claisse M4 is a machine used for preparation of Glass Beads by the use of flux & sample. This technique uses minimal sample (1g) which is prepared by fusion and preparing homogenized glass disks, which eliminate particle and matrix effects, resulting high analytical accuracy.



10.3 Stable Isotope Ratio Mass Spectrometer (IRMS)

The mass spectrometry facility is equipped with a delta V advantage. Stable Isotope ratio mass spectrometer (IRMS) coupled with an Elemental Analyzer Flash EA2000 and Gas Bench II sample preparation device to perform continuous-flow high-precision stable hydrogen ($\delta^2\text{H}$), oxygen ($\delta^{18}\text{O}$), carbon ($\delta^{13}\text{C}$), and nitrogen ($\delta^{15}\text{N}$) isotope ratio analyses on a variety of inorganic and organic samples including carbonate sediments, soils, water, plants, organics, aerosols, atmospheric gases, archaeological materials, animal tissue, bone collagen, etc

Application:

The Elemental Analyzer, and Gas Bench devices are used for on-line extraction of gas-phases from samples and introduction of the purified gases directly into the ion source of mass spectrometer for stable isotope ratio measurements. The elemental Analyzer with an automated solid sampler is used to combust solid inorganic/organic samples in continuous-flow for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ analyses. The Gas Bench II system is used for temperature dependent carbonate-acid reaction and extraction of CO_2 gas, which is subsequently measured for $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values. This system can also be used for carbonate samples, gaseous species, dissolved inorganic carbon, and for water isotope (δD and $\delta^{18}\text{O}$).



Model: Thermo Scientific Delta V advantage IRMS; Flash EA-2000; ConFlo IV universal Interface; Gas Bench II System

CONTACT

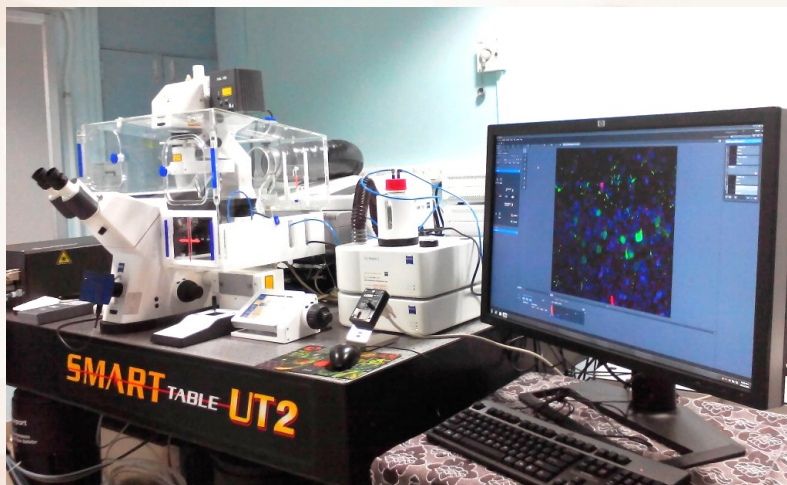
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11. LIVE CELL IMAGING LAB

11.1 Advanced Highly Sensitive Spectral Confocal and Multiphoton Microscope System for Live Cell Imaging



Model: LSM780NLO, Carl Zeiss GmbH

The ACMS expanded its limit from the field of material science towards field of bio-science and bio-engineering, by taking a leap towards the highly advanced characterization of live-cell imaging. This advanced live-cell imaging facility includes two units. The first is a high-end inverted fluorescence microscope with onstage incubator for cell culture; and the second is a programmable motorized control features (X, Y and Z scans) for capturing bright field and fluorescence imaging using a high resolution Peltier cooled monochrome camera.

Specifications:

- Possible imaging for DAPI, rhodamine, TRITC, FITC, GFP, YFP, and CFP
- Supported with tuneable femtosecond laser source (tuning range: 690-1040nm) with PMT and GaAsP modules for signal detection.
- Capable of simultaneous acquisition and separation of 10 fluorophores
- Software controlled modules for controlling all motorized components of microscope, laser scan head, laser module, stage incubation system and the digital camera.
- Additional incubator and bio-safety cabinet for handling of mammalian cell and tissue cultures.

Application:

- Imaging dynamic morphometric changes in cells and organ cultures using fluorescence markers to understand properties such as cell growth, differentiation and migration.
- Photo activation or photo-conversion to mark a single cell, organelles in a cell or molecules in a cell to track dynamic changes over time in response to changes in environment.
- Intracellular trafficking such as cargo delivery and their fate using fluorescence probes.
- FRET analysis to quantify the proximity and interaction molecules in a living cell.
- Imaging of dynamic changes in the cellular physiology such as changes in the levels calcium, pH, etc.
- Checking efficiency of contrast reagents and organ cultures.

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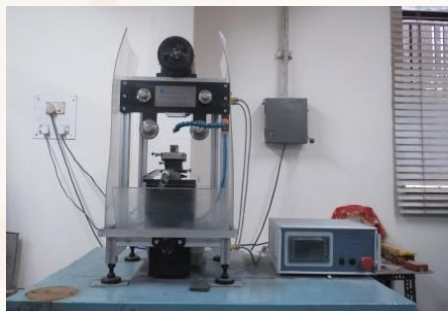
12. SAMPLE PREPARATION FACILITY/WORKSHOP



12.1 Vibrometer

Model: Buehler, Vibromet 2

This Vibratory Polisher can be used to prepare high quality polished surfaces on a wide variety of materials. It also removes any minor deformations remaining on surface. Oscillating horizontally at 7200 cycles per minute horizontal motion, produces a very effective polishing action, providing exceptional flatness. Using with colloidal silica suspension 40 nm, it chemo-mechanically polish a specimen to a surface finish suitable for EBSD.



12.2 High Precision Diamond Wire Saw

Model: STX-202A, MTI Corporation

This is a small precision diamond wire saw for cutting sample $\leq 2''$ diameter or square up to 50mm in thickness. It is designed to provide smooth cutting for many kinds of materials, especially for fragile crystals and TEM or IC samples for electron microscopy. The sample stage's dimension are, max. height: 10mm, max. cross section: 20mmx40mm, automatically controlled by the digital panel. Two-dimension sample stage built-in 360° degree horizontal rotating and $\pm 10^\circ$ tilting vis manual operation.



12.3 Spark Erosion Machine

Model: MS NW Ltd. Spark Erosion Mk.2

Spark erosion unit is used for preparation of TEM samples. The sample size that can be prepared is 3mm disk and specimen height 500 microns.



12.4 Lathe Turning Machine

The workshop has a dedicated lathe for sample preparation that can be prepared using lathe machining. The mechanical test specimens, any custom fixture or any kind of sample preparation that needs lathe can be requested to prepare.

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13. NATIONAL FACILITY FOR ATOM PROBE TOMOGRAPHY (NFAPT)

NFAPT houses the work-station for atom probe tomography (APT) facility installed at IIT Madras, which has state-of-the-art technology of "Local Electrode Atom Probe (LEAP 5000 XR)" along with "Helios Dual Beam Scanning Electron Microscope with Focussed Ion Beam (FIB)" for sample preparation. A sharp tip sample is prepared using Focused Ion Beam (FIB) and LEAP allows characterising the samples ($50 \times 150 \times 500 \text{ nm}^3$) at the sub nanometer spatial resolution by providing 3D atom-by-atom imaging and chemical information using time of flight mass spectrometry. APT exhibits extraordinary capabilities such as atomic resolution (lateral resolution: 0.3-0.5 nm and depth resolution 0.1-0.3 nm), 3D information about the position of the each atom in the analysed sample and chemical sensitivity down to atomic parts per million. With 8 h slot per week, we can analyze one or two samples, prepared using FIB.

13.1 LEAP 5000 XR



Model: LEAP 5000 XR

Specifications:

- Reflectron ion optic design
- Field of view up to 200 nm
- Voltage and Laser modes
- Mass resolving power 1100
- Specimen temperature 25K to 80K
- 355 nm UV laser for laser mode
- Laser energy range from 0.001pJ to 1000pJ
- Less than 3 micro meter laser spot size
- Upto 500kHz pulse rate for laser
- Spatial resolution $\{\Delta x \approx \Delta y \approx 0.3\text{-}0.5 \text{ nm} \ \& \ \Delta z \approx 0.1\text{-}0.3 \text{ nm}\}$

13.2 Focused Ion Beam (FIB)

Specifications:

- Elstar electron column with UC+ technology
- Phoenix Ion Column with Fast Beam Blanker
- 150 x 150 mm eucentric piezo stage
- In-lens detector TLD - with SE and BSE modes
- Secondary electron detector (SED)
- In-column detectors - ICD and Mirror detector
- ICE detector,
- CCD IR camera,
- In-chamber Nav-Cam
- Integrated plasma cleaner
- EDAX EDS system
- EBSD System



Model: HELIOS G4UX

13.3 TecnaiG2 Spirit Twin

Specifications:

- LaB6 emitter
- High voltage range 20 - 120 kV
- Line resolution 0.20 nm
- Maximum eucentric tilt $\pm 70^\circ$
- GatanUS1000XP-P camera for 300 kV
- AutoAdjust and AutoGun Automation software

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14.1 Laser Particle Sizer

The “analysette 22” laser particle sizer is used for determining particle size distribution of solids or drops in a liquid or gas (suspensions, emulsions, or aerosols). Particle size is calculated by measuring the angle of light scattered by the particles as they pass through a laser beam. It is ideal for especially efficient particle size analysis – in production and quality control as well as in research and development or for controlling manufacturing processes. Laser diffraction analyzer is used in many applications, including manufacturing, quality control and product development.

Specifications:

- Measuring range: 0.1 μm – 25 μm (smallest range), 10 μm – 1250 μm (largest range)
- Analysis method: Static light scattering (laser diffraction)
- Type of analysis: Dry Analysis (for powder), Wet analysis (Wet measurement of the particle size of solids, suspensions and emulsions)



Model: Fritsch GmbH, analysette 22

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Prof. Kantesh Balani

Dept. of Materials Science & Engg.
Head, ACMS & Faculty Convenor
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PHOTO GALLERY



ACMS Open House 2020 (Date: 6th March/2021) | Day inaugurated by Director, IIT Kanpur

| Pic Courtesy: Information Cell IITK



[Left to Right] Pic-1: A Ph.D student working on micro-indentation facility. Pic-2: Lab staff giving training on Electron Microscopy. Pic-3: Lab staff performing experiment on UTM Machine. Pic-4: Facility users (PhD Students) from XRD Lab along with Lab Staff. Pic-5: Students working in Electrical Characterization Facility. Pic-6: Lab Staff giving training on Nano-indentation. Pic-7: Head, ACMS Prof. Kantesh Balani welcomes Director, IIT Kanpur for the opening ceremony of ACMS's open-house. Pic-8: Lab staff giving demonstration to Director. Pic-9: Ex-head Prof. Gouthama giving brief of the lab.

LIST OF ALL LABS, EQUIPMENT & CONTACTS

*(In order of Room No. and Lab Name)

*Phone Extension: 0512-259-XXXX

Room No. #	Lab and Instruments	People & Contact*
1 st Floor		
101	XRF/IRMS Lab <ul style="list-style-type: none"> X-Ray Fluorescence Spectroscopy (XRF) Isotope Ratio Mass Spectrometer (IRMS) Claissse M4 Glass Bead Making Machine 	Faculty Convenor: Prof. D. Paul (dpaul@iitk.ac.in) [6169 / 4608] Staff: Abhishek Kumar (krabhish@iitk.ac.in) [7780]
102	Thermal Processing Lab <ul style="list-style-type: none"> OES optical emission spectrometer (OES) Ball-milling (Traditional) Ultra-sonic Cleaner RFM Wear tester Vacuum sealing unit Hydraulic Press 	Faculty Convenor: Prof. Anish Upadhyaya (anishu@iitk.ac.in) [7672] Staff: Mr. Kamlesh Thapliyal (kamlesht@iitk.ac.in) [6999]
103	Sample Preparation Facility/Workshop <ul style="list-style-type: none"> Vibratory Polisher High Precision Diamond Wire Saw Wire Electric-Discharge Machine (EDM) Lathe Turning Machine 	Faculty Convenor: Prof. Sudhanshu Shekhar Singh (sudhanss@iitk.ac.in) [6908] Staff: Mr. Jai Kishan (jai@iitk.ac.in) [7624]
104	Mechanical Testing Lab <ul style="list-style-type: none"> Instron-1195 UTM MTS-610 UTM 100 KN Hydraulic UTM with Environmental Chamber 100 KN Axial Torsion System with Induction furnace 50 KN Creep Testing Machine with 1000° Celsius Furnace 50 KN Slow Strain Rate Testing System with liquid bath Zwick Instrumented Charpy Impact (108A) 	Faculty Convenor: Prof. Sudhanshu Shekhar Singh (sudhanss@iitk.ac.in) [6908] Faculty Convenor: Prof. Kallol Modal (kallol@iitk.ac.in) [6156] Staff: Mr. Ram Krishna (ramkris@iitk.ac.in) [7878] Staff: Mr. Anoop Raut (anoopr@iitk.ac.in) [7878]
105	Magnetics Testing & Squid Lab <ul style="list-style-type: none"> Vibrating Sample Magnetometer (VSM) SQUID Facility 	Faculty Convenor: Prof. Satyajit Banerjee (satyajit@iitk.ac.in) [7559] Staff: Mr. M.Siva Kumar (rmuthu@iitk.ac.in) [6292/ 6293/6294] Mr. Jai Kishan (jai@iitk.ac.in) [7624]
107	X-Ray Diffraction (XRD) Lab <ul style="list-style-type: none"> PANalytical XRD Two Circle Diffractometer Four Circle Diffractometer 	Faculty Convenor: Prof. Nilesh Gurao (npgurao@iitk.ac.in) [6688] Staff: Mr. Ashish Tiwari (ashishtr@iitk.ac.in) [7814]
108A	Thermal Analysis, Hardness & Impact Lab <ul style="list-style-type: none"> Thermo-Gravimetric analyzer (TGA) Differential Scanning Calorimetry (DSC) 	Faculty Convenor: Prof. K Balani (kbalani@iitk.ac.in) [6194] Staff: Mr. Kamlesh Thapliyal (kamlesht@iitk.ac.in) [6999] Staff: Mr. Rupesh Sharma (rupeshks@iitk.ac.in) [6999]
	<ul style="list-style-type: none"> Universal Hardness Testing Machine 	Faculty Convenor: Prof. Sudhanshu Shekhar Singh (sudhanss@iitk.ac.in) [6908] Staff: Mr. Rupesh Sharma (rupeshks@iitk.ac.in) [6999]
110	Surface Characterization Lab <ul style="list-style-type: none"> X-ray Photoelectron Spectroscopy (XPS) Facility 	Faculty Convenor: Dr. T.G. Gopakumar (gopan@iitk.ac.in) [6830] Staff: Mr. DD Pal (ddpal@iitk.ac.in) [6906]
110A	Profilometry Lab <ul style="list-style-type: none"> Surface Profilometry Facility (at 110A) 	Faculty Convenor: Prof. K Balani (kbalani@iitk.ac.in) [6194] Staff: Mr. Kamlesh Thapliyal (kamlesht@iitk.ac.in) [6999] Staff: Mr. Rupesh Sharma (rupeshks@iitk.ac.in) [6999]

LIST OF ALL LABS, EQUIPMENT AND CONTACTS

	Lab and Instruments	People & Contact
112	Electron Microscopy Lab <ul style="list-style-type: none"> Field Emission Scanning Microscope (FESM) <ul style="list-style-type: none"> In-situ Tensile Testing Electron Back Scattered Diffraction based orientation imaging microscopy (EBSD) Scanning Electron Microscope- Tungsten, Jeol (W-SEM) Scanning Electron Microscope- Tungsten, FEI-Quanta (W-SEM) Optical Microscopy with DIC Imaging Gold/Carbon Sputtering Coating Plasma Cleaner 	Faculty Convenor: Prof. S. Shekhar (shashank@iitk.ac.in) [6528] Staff: Mr. M.Siva Kumar (rmuthu@iitk.ac.in) [6292/ 6293/6294] Mr. Mitesh Shrotriy (mitesh@iitk.ac.in) [6284/6293] Mr. Jaikishan (jai@iitk.ac.in) [6284/6293]
	<ul style="list-style-type: none"> Electron Probe Micro-Analyzer (EPMA) 	Faculty Convenor: Prof. K. Kulkani (kkaustub@iitk.ac.in) [6102] Staff: Mr. M.Siva Kumar (rmuthu@iitk.ac.in) [6292/ 6293/6294] Mr. Mitesh Shrotriy (mitesh@iitk.ac.in) [6284/6293] Mr. Jaikishan (jai@iitk.ac.in) [6284/6293]
	<ul style="list-style-type: none"> Atomic Probe Tomography (APT) 	Faculty Convenor: Prof. Kantesh Balani (kbalani@iitk.ac.in) [6194] Faculty Co-convenor: Prof. Krishanu Biswas (kbiswas@iitk.ac.in) [6184]
	Micro & Nano Indentation Lab <ul style="list-style-type: none"> Instrumented Micro Indentation Instrumented Nano Indentation 	Faculty Convenor: Prof. K Balani (kbalani@iitk.ac.in) [6194] Staff: Mr. Kamlesh Thapliyal (kamlesht@iitk.ac.in) [6999] Staff: Mr. Rupesh Sharma (rupeshks@iitk.ac.in) [6999]
113	Thermal Processing Facility (Extension) <ul style="list-style-type: none"> BET Surface Area Analyzer (BET Solar Simulator) 	Faculty Convenor: Prof. Anish Upadhyaya (anishu@iitk.ac.in) [7672] Staff: Mr. Kamlesh Thapliyal (kamlesht@iitk.ac.in) [6999] Staff: Mr. Rupesh Sharma (rupeshks@iitk.ac.in) [6999]
	2nd Floor	
201	Electrical Characterization Lab <ul style="list-style-type: none"> Cryogenic Probe Station Probe Station with Heating Stage Semiconductor Parameter Analyzer Table Top Hall Effect Measurement System Sheet Resistance Measurement System - Pro4 	Faculty Convenor: Prof. Sarang Ingole (sarang@iitk.ac.in) [7089] Staff: Mr. Pushpendra Kumar (pkdohare@iitk.ac.in) [7879]
	<ul style="list-style-type: none"> Thermoelectric Characterization System Piezo, Ferro, Pyro-Electric materials characterization Closed Cycle Cryostat with Electro-Magnet Plasma Sputter Coater Near Field Scanning Optical Microscope 	Faculty Convenor: Prof. Tanmoy Maiti (tmaiti@iitk.ac.in) Staff: Mr. Pushpendra Kumar (pkdohare@iitk.ac.in) [7879]
	<ul style="list-style-type: none"> Impedance Analyzer LCR Meter High Temperature Probostat 	Faculty Convenor: Prof. Shobit Omar (somar@iitk.ac.in) Staff: Mr. Pushpendra Kumar (pkdohare@iitk.ac.in) [7879]
209	Live Cell Imaging Facility <ul style="list-style-type: none"> Advanced Highly Sensitive Spectral Confocal and Multiphoton Microscope System for Live Cell Imaging 	Faculty Covener: Prof. Nitin Mohan (nitinm@iitk.ac.in) [4103] Staff: Ms. Neetu Dey (neetud@iitk.ac.in) [7830]

ADVANCED CENTRE FOR MATERIALS SCIENCE (ACMS)

Indian Institute of Technology Kanpur

Objectives of ACMS

- ❖ Support R&D activities by ensuring easy accessibility and maximum utilization of sophisticated analytical equipment with minimal downtime.
- ❖ Support mega project of IITK faculty and researchers/Industry.
- ❖ Establish facilities that cover all possible aspects of material characterization.
- ❖ Contribute towards development of well-trained manpower for industry, academia and research through a series of short-term workshops/courses/seminars.



REACH US

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