

Centralized instrument facility

- 1) Vibrating sample magnetometer
- 2) Bruker High resolution X-ray diffractometer
- 3) Perkin Elmer FTIR spectrometer with ATR & Specular reflectance
- 4) Agilent LCMS with Quadropole time of flight
- 5) Thermal analysis Perkin Elmer TGA, DTA and DSC
- 6) Waters Differential Scanning Calorimeter
- 7) Jeol 400 MHz Nuclear Magnetic resonance
- 8) TEM sample preparation equipment
- 9) Critical point dryer
- 10) Jeol scanning electron Microscope (SEM) with EDS
- 11) FEI High Resolution Transmission electron microscope (TEM)
- 12) CHNS Analyzer
- 13) **Liquid nitrogen** (LN₂) storage tank and distribution facility
- 14) Renishaw Laser Raman Spectrometer
- 15) Cary Eclipse Fluorescence spectrophotometer (solid and liquid samples)
- 16) Time resolved Fluorescence spectrometer (Horiba Yvon)
- 17) Sentech Ellipsometer
- 18) Upconversion and downconversion fluorescence spectrometer
- 19) Linesis TGA with auto sampler
- 20) Thermo fisher FTIR spectrometer with FIR attachment
- 21) Broadband Dielectric/impedance analyzer (mHz to 10 MHz)
- 22) Jasco Circular dichroism spectropolarimeter
- 23) B.E.T. surface area analyzer
- 24) Zeiss FESEM
- 25) Single crystal X-ray diffractometer
- 26) Nikon confocal microscope



Vibrating Sample Magnetometer

1) Vibrating sample magnetometer

Make: Microsense, Model ADE – EV9

Specifications:

Magnetic field Up to 2.2 Tesla

Field resolution: 1×10^{-3} Oe

Sensitivity: 5×10^{-5} emu

Temp. variation 100 to 1000K

Magneto resistance (Between 1 and 10,000 Ω)

Measurements: Virgin curve, Hysteresis loop

Isothermal remanence

DC demagnetization

Angular remanence

Temperature scan



Bruker High Resolution
X-Ray Diffractometer

2) High resolution X-ray Diffractometer

Make: Bruker, D8 Discover,

X-ray source Cu, 3KW

Specifications:

Sample stage Eulerian cradle with 6 degrees of freedom, Optical system: 2D area detector, scintillation detector,

Powder diffraction, Rocking curve, X-ray reflectometry, grazing incidence diffraction measurements, and structure refinement.

High temperature attachment RT to 1500°C.

Low temperature attachment 77K to RT



Perkin Elmer FT-IR

3) FT-IR spectrometer

Make: Perkin Elmer

Model: Spectrum RXI – Mid IR

Specifications: Range 400 to 4000 cm^{-1}

Resolution 1 cm^{-1}

Source: Nichrome wire

Detector: Lithium Tantalate

Beam splitter: KBr

Accessories: HATR and Diffuse reflectance.

Analysis of powder, gel, paste, emulsion, pure liquid, solution and polymer films.



Agilent HR-LCMS

4) High resolution liquid chromatography Mass spectrometer with Quadrupole Time-of-flight

Make: Agilent G6530AA (LC-HRMS-Q-TOF)

Specifications:

Source – ESI and APCI source.

Mass accuracy: > 2ppm

HPLC pressure: 600 Bar, MS pressure: 10^{-4} to 10^{-5} Torr

Resolution: 20,000

Features: Molecular formula determination, Accurate molecular weight determination, molecular structure determination, and Reaction kinetic studies. Agilent Jet stream technology. Mass Hunter workstation data mining tools for high resolution accurate mass analysis.



Perkin Elmer DTA/TGA/DSC

5) Thermal analysis (TGA/DTA)

Make: **Perkin Elmer**, Pyris diamond TGA/DTA

Specifications: Range RT to 1100°C

Analysis of kinetics of decomposition, weight loss, Thermal stability assessment, Glass transition temperature, Heat flow measurements, and kinetics of drying.



Waters (DSC)

6) Differential scanning calorimeter (DSC)

Make: **Waters** (TA instruments)

Model: Q200 modulated DSC with mass flow control

Operating Temp. range -90° C to 725°C

Refrigerated cooling system -90°C to 550°C

Sensitivity: 0.2 μ W, Precision $\pm 0.05^\circ$ C

Accuracy $\pm 0.1^\circ$ C

Heating and cooling rate:

Sample pan : Aluminum pans

Features: Thermal conductivity (Modulated DSC) Isothermal kinetic studies, Purity measurements, and glass transition temperature.



Jeol Nuclear magnetic Resonance (400 MHz)

7) Nuclear magnetic Resonance

Make: Jeol, Model: JNM-EXCP 400
Specifications: 400 MHz FT NMR, 2 RF channels
Observable Nuclei: Multinuclear, Full range
1H, 13C, 19F all nuclei between 15N-31P
Stability 0.1 Hz/hour (²H internal lock used)
Standard frequencies: ¹H : 400 MHz, ¹³C:100 MHz
Variable temp. facility: -140 to 180° C
Gradient strength: 0.3T at 10Amp setting
Auto sampler capacity 64 samples
Sound proof air compressor
Users submit samples in their own NMR tubes (5mm) with caps in the morning before 11: 00 AM and collect the data in the evening.



TEM sample preparation

8) TEM sample preparation equipment

Make: Gatan and Quorum Technologies

- 1) Ultrasonic cleaner
- 2) Diamond Saw blade dicing unit
- 3) Gatan 601 Ultrasonic disc cutter
- 4) Glass lapping discs with polishing paper
- 5) Hot plate
- 6) Gatan 656 Dimple grinder
- 7) PIPS ion polishing machine
- 8) Gold sputter coater and Carbon evaporator
- 9) Oven (40 to 260°C)

Users are expected to learn the operation of the above equipment and prepare their samples.



Critical point dryer

9) Critical point dryer

Leica Critical point dryer CPD 300 (installed)
Fully reproducible process
Possibility for storing and retrieving recipes And programs.
Timer function, minimized Co2 consumption
Flexibility in sample size
Easy to use – intuitive software, with Touch sree interface.



Jeol Scanning Electron Microscope

10) Scanning Electron Microscope

Make: JEOL Japan Mode: JSM 6610LV
 Mode: High and Low vacuum mode
 Electron Sources: Tungsten or LaB₆ filament
 Voltage: 1-30KV
 Magnification: X5 to X 3,00,000
 Resolution: 3nm with High Vacuum mode
 Peltier Stage: -25°C to +50°C
 Gold sputter coater JEC 300
 Detector: Secondary, Backscattered and LN₂ free EDS detector.
 Features: Surface morphology, Topography, Elemental analysis with EDS, 3D analysis with 3D software.



FEI Transmission Electron Microscope (300KV)

11 Transmission Electron Microscope

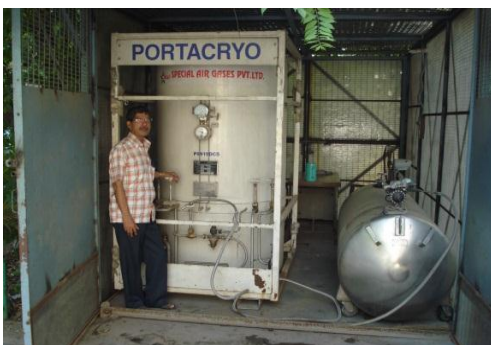
Make: FEI Netherlands,
 Model: Technai G²T30,U-Twin
 Specifications:
 Electron Source: Tungsten or LaB₆ filament
 Voltage: 50-300 KV
 Resolution: 0.19nm
 Magnification: 58X - 970KX (TEM), 100X-5MX (STEM)
 Camera Length: 80-5600mm
 EDS solid angle: 0.13 steradians
 Features:
 Morphology of particles & particle size distribution, Elemental analysis & STEM,



Elementar CHNS Analysis

12) CHNS Analyzer

Make: Elementar Analysensysteme Germany
 Model: Vario Micro Cube
 Specifications:
 Simultaneous determination of CHNS, CNS, S in organic and inorganic solids and liquids. Oxygen determination – optional. Inhomogeneous, highly volatile and sensitive substances.
 Automatic sample feeder for *max.* 79 samples
 Sample size = 0.02 – 1000mg
 Combustion Temp: 950 to 1200°C (selectable)
 Combustion Time: 0.1 to 6 min
 Carrier gas : Helium



Liquid Nitrogen Storage & Distribution

13) Liquid Nitrogen storage tank and distribution

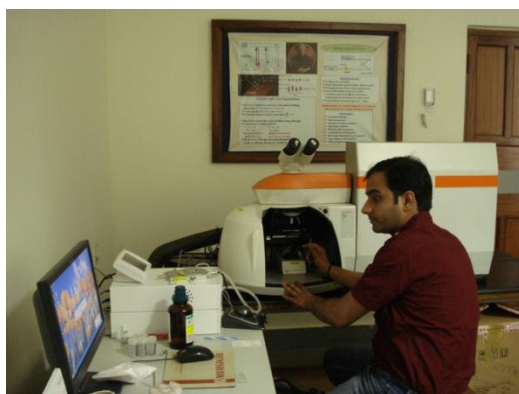
950 liter Portacryo liquid nitrogen tank (rented)
600 liter SS cryogenic tank
200 liter Cryo container for NMR

Liquid nitrogen distribution timings:

Monday: 10:30 to 12:30 noon

Thursday: 2:30 to 4:30 PM

Liquid nitrogen supplier: M/s Star special gases
Users are requested to bring their own LN2 containers, and pay the charges for the Liquid nitrogen in advance at the Univ. cashier, and collect liquid nitrogen.



Laser Raman spectrometer

14) Renishaw Laser Raman spectrometer

Model: Invia II

Specifications:

Source: 785 nm and 514 nm LASER

Hi frequency 200 to 3200 cm^{-1}

Low frequency 10 to 750 cm^{-1} using 514 nm

Resolution – better than 1 cm^{-1}

Confocal Raman microscopy

Spot size < 10 μm

Temperature variation -196°C to 200°C

Solid and liquid samples, powders & thin films.



Fluorescence spectrometer

15) Cary Eclipse Fluorescence spectrometer (Liquid samples)

Source: Oxygen free 150 W Xenon lamp

Plane grating Czerny-Turner design maintaining focus at all wavelengths

Excitation: 200-950 nm, Emission :200-950 nm

Bandpass: Computer controlled 0 – 30 nm, continuously adjustable.

Wavelength accuracy: ± 0.5 nm at 541.92 nm

± 1.0 nm at 200-950 nm

Step size: 0.15 to 30 nm, Scan speed: 400 nm/s

Integration time from 1 ms to 160

Cuvette size: 4 ml, 1 cm path length,

Quartz cuvette stoppered 250 μL micro quartz cell



Time resolved Fluorescence

16) Time resolved Fluorescence

Lifetime system with emission
Monochromator and diode excitation
UV pulsed LED source (280 and 370 nm)
Blue pulsed LED source (460 nm)
Green pulsed LED source (560 nm)
Metallic ND filter, Automated polarizer,
Quartz fluorescence cell with PTFE stopper



SENTECH ELLIPSOMETER

17) SENTECH ELLIPSOMETER

Model No.: SEN research SE 850 DUV Variable angle spectroscopic Ellipsometer
Spectral Range: 190-2300nm
Motorized Goniometer : 40°90°,step with 0.01°
Fixed 150 mm Sample stage
Temperature control stage : 4K – 700K
Motorized Stage and Mapping Software
Video Camera Unit for sources Alignment
CCD Camera for Sample Alignment
Light Source: Deuterium for UV, Halogen Lamp for Visible and NIR range
Spot Size : 1-4mm
Micro spot of 200 μ for UV-VISIBLE Range
Sample Holder for Transmission measurement



**Upconversion and down conversion
fluorescence spectrometer**

18) Upconversion and downconversion fluorescence spectrometer

Model QM-8450-11, Quanta master
450W Xe lamp, 1800l/mm grating
Cooled PMT detector R928 PMT
QM-400 Phos lifetime measurement
Computer controlled shutter
Nano LED 375, 250, 280, & 320 nm
7 longpass filters 330,395,455,495,550,590
980 nm 2W adjustable powder CW laser
Quanta-Phi 6" integrating sphere
Provision for Powders and liquid samples



TGA with auto sampler

19) Linesis TGA with auto sampler

- Model TGA HiRes1000
RT to 1100C, Top loading
Gas dosing possible, 2 gas MFC's
Heating rate 0.01 to 200 °C/min
Forced air cooling
Sample weight 2 gm
Resolution 0.1 µg
Auto sampler: 42 positions
Temperature accuracy $\pm 2^{\circ}\text{C}$
Balance sensitivity : 0.5 µg
Balance accuracy <1%
Balance precision 1%



FTIR with FIR attachment

20) Thermofisher FTIR spectrometer with FIR attachment

- Nicolet iS50 FTIR Tri-detector
Gold flex spectrometer – Gold optics (0.09 cm^{-1} resolution),
Automated beamsplitter exchange MIR-FIR
- DLaTGS detector with KBR window
- Ge-on-KBr beamsplitter (7800-350 cm^{-1})
- iS50 Build-in Diamond ATR module (5000 to 100 cm^{-1})



Broadband impedance analyzer

21) Broadband Dielectric spectrometer

Make: Novacontrol Technology
Dielectric/Impedance analyzer
Temp variation: -196°C to $+300^{\circ}\text{C}$
Frequency range 10^{-3} Hz to 10^7 Hz
Automatic data acquisition
Graphical online display of measured electrical parameters, temperature variation and system status. Automatic calibration of Hardware devices and sample cell. Optional curve fitting software – Win Fit.



Circular Dichroism spectro polarimeter

22) Circular Dichroism spectropolarimeter

JASCO-CD POLARIMETER
MODEL: J-815(150-S)
Source : 150 W XENON ARC LAMP
Wavelength range : 163-900 nm
Wavelength accuracy : 0.2nm
Spectral bandwidth : 0.01-15nm
Scanning modes :Auto response, continuous, and step
Scanning speed : 1nm -10,000 nm /min.
UV measurement : 0-5Abs.
Rectangular cells of 1mm, 2mm,5mm 10 mm Path length
Simultaneous measurements of absorption spectra
Peltier Temp. Control unit



BET Surface Area Analyzer

23) BET surface area analyzer

Make: Quantachrome Instruments

Model: ASI-CI-11

Adsorbate temperature 77 K

User defined analysis for fast and simple measurement initialization.

Automatic error checking



FESEM

24) Zeiss field emission scanning Electron microscope (FESEM)

- Zeiss GeminiSEM 500
- Thermal field emission type
- Acceleration voltage 0.02 – 30kV
- Probe current 3 pA – 20nA
- Magnification 50 – 2,000,000
- EDS detector
- Angular selective backscattered detector
- Inlens secondary electron detector
- Everhart Thornley secondary electron



Single Crystal X-Ray Diffractometer

25) Single crystal X-ray diffractometer

MAKE : Oxford Diffraction

Model: X-Calibur-S Single Crystal XRD

4-Circle Kappa platform with enhanced X-ray source

X-ray Tube: Ceramic Fine Focus(Mo/Cu)

Cryojet System :90-300K

Capillaries : (Quartz with 0.2, 0.3, 0.5 & 0.7 mm OD)

Sapphire CCD Detector: (2048 x 2048 pixels)

Resolution: 0.001 deg. For Omega & Theta

0.003 deg. For Kappa

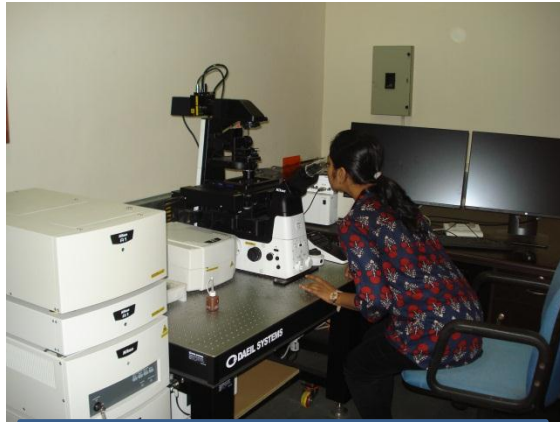
0.005 deg. For Phi

Scanning Speed Range: 0.005-3.0 deg./sec.

SPELLMAN DF60N3 X-Ray Generator 4.2KW

Video Microscope for color images of the crystal

CrysAlis^R software package



Confocal Microscope

26) Nikon confocal microscope

- Nikon Laser scanning confocal microscope
- Microscope having live cell facility
- Motorized inverted microscope
- Resonant scanner (for high speed imaging)
- XY motorized stage (multi point time lapse imaging)
- Motorized fluorescence attachment
- PC controlled 130W Hg fiber illuminator
- CO2 incubation system with controlled Temp and humidity control
- Software for offline analysis