UPES
UNIVERSITY OF TOMORROW
RESEARCH & DEVELOPMENT

CENTRAL INSTRUMENTATION CENTER

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
DEHRADUN, UTTARAKHAND

Central Instrumentation Center (CIC) was inaugurated by "Padma Bhushan Dr. R. Chidambaram" on 27th February 2014. This facility is aimed to provide data collection from sophisticated, analytical equipment's to scientific community for their advanced research and also to facilitate cutting edge technologies for your needs.

MAJOR FACILITIES AVAILABLE

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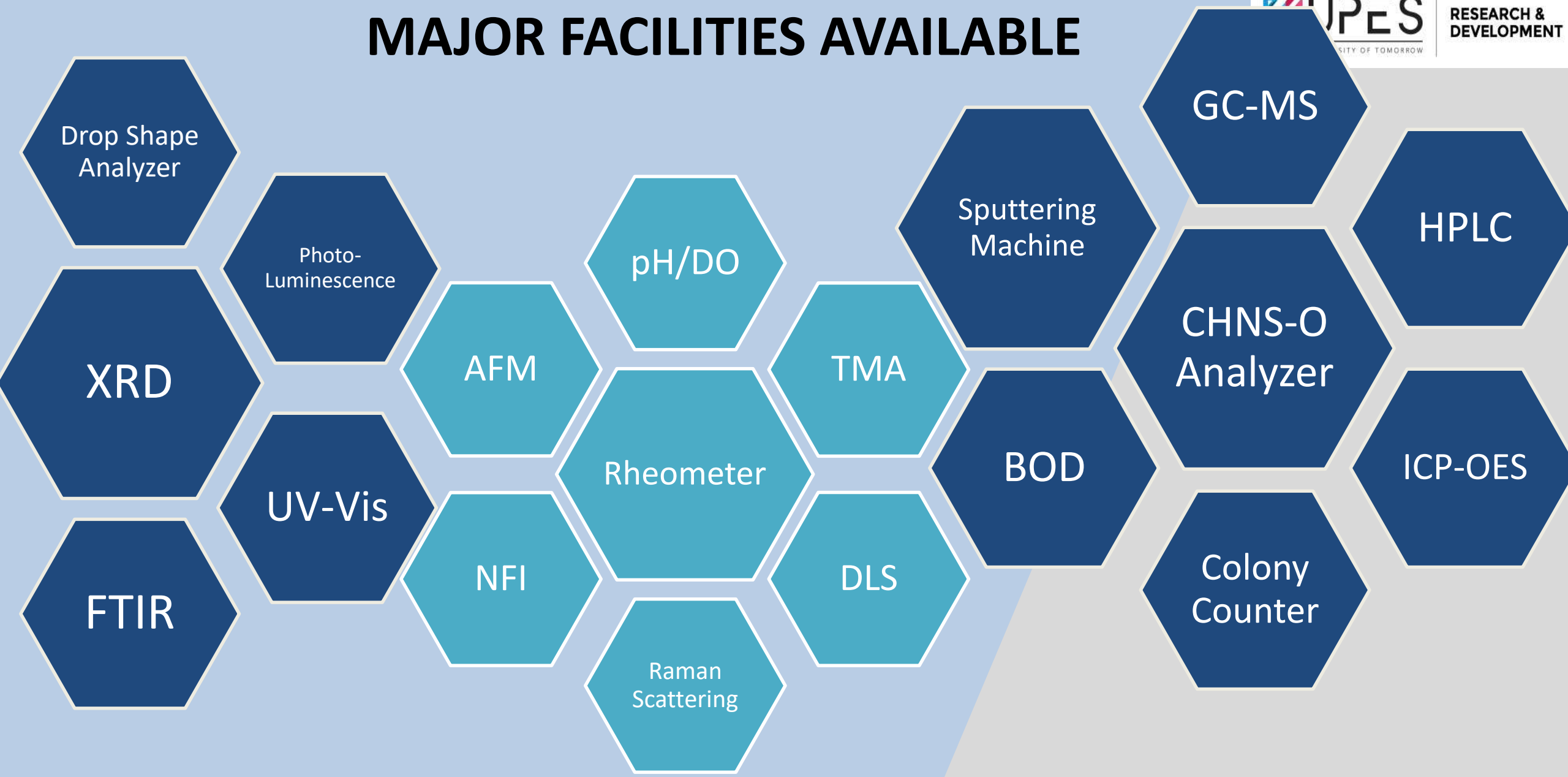


FT-IR (Frontier FT-IR/FIR, Perkin Elmer)

- Detection of Functional groups and characterizing co-valent bonding information.
- Stretching and Bending vibrations of organic compounds
- Support in Identification of components in a mixture of components.
- Provide information about structure of material.
- Understanding the unknown contaminants in industrial samples.

XRD (D8 ADVANCE ECO - Bruker)

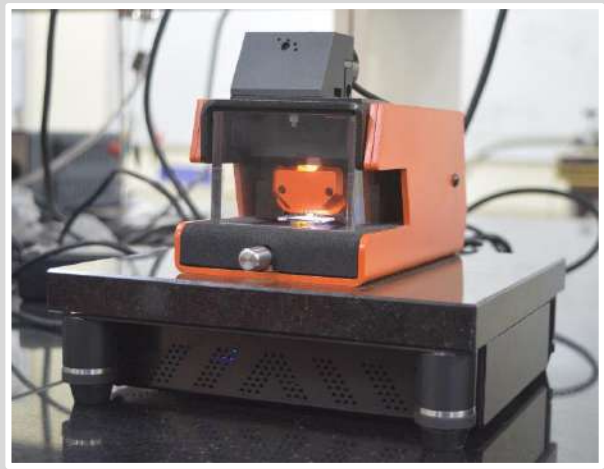
- Non –destructive techniques to identify crystalline phases and orientation.
- To determine structural properties: strain, grain size, epitaxy, phase composition, ordered disordered transformation, thermal expansion etc.
- To determine crystalline and amorphous arrangements.
- Measurement of thickness of layers
- Determination of texture of poly grained material

Spectro Photo meter UV-Vis (LAMDA 35, Perkin Elmer)

- Determination of metal and organic non-metal analytes in water
- Characterization of petrochemical Products
- To generate quick and easy methods for common food analyses without the need for extensive training ensuring that the correct results are reported without compromising food quality.
- High optical quality for environmental analysis.

Atomic Force Microscope (NANOSURF AG)

- Image of material surface at atomic resolution.
- Determine the roughness of surface samples and measure the thickness of crystal growth.
- Imaging of non-conductive biological surfaces.
- Applicable for quantification of abrasion, adhesion and corrosion of surfaces.



CHNS-O Analyzer (Flash 2000 Series, Thermo Scientific)

- To analyse organic CHNSO composition of the solid and liquid samples from 0.01 to 100% using TCD.
- To analyse trace level sulphur up to 25 ppm using FPD
- Organic CHNSO composition of solid and liquid samples such as biomass, bio-oil, liquid and solid fuels.
- Provide information about structure of material.
- Predicting theoretical calorific value from the CHNSO composition of the sample.

ICP-OES (Plasma Quant 9000- Analytikjena)

- Direct Analysis of Saline Matrices.
- Composition Analysis of an Electrolytic Etching Solution.
- Specification Analysis of Gasoline.
- Trace Metals Analysis in Water-Methanol-Oil Mixtures.
- Analysis of Rare Earth Elements in Granite and Sandstone.
- Analysis of High-alloyed Steel.

Contact Angle Goniometer/Drop Shape Analyzer (DSA25, Kruss)

- Characterization of surface pre-treatment processes
- Investigation of the adhesion and stability of bonding and coating processes
- Investigation of coating substances in accordance with DIN 55660
- Checking the wettability of plastic, glass, ceramic, wood or metal
- Quality control for wafers and microelectronics

Nano fluid interferometer (Mittal Enterprises-NF10)

- Characterization of Nanofluids like Ag/Au & Ferrofluids etc.
- To evaluate modest nanoparticles concentration in the fluid for significant enhancement of its property.
- Prediction of enhanced thermal conductivity due to suspension of the metallic nanoparticles with very low concentration in to the polymeric fluids.
- Sound Velocity and compressibility of nanoparticles with liquid suspension.
- Study of Phase transition and to detect/assess weak and strong molecular interactions in Nanofluids.
- To determine the extent of complexation and calculate the stability constants of such nanofluid complexes.

Particle size analyzer (ZEN1690, Malvern Instruments Ltd, 2013)

- For solids, the surface area of the particle is critical in determining the rate of chemical reaction.
- Particle characterization analyzers have found uses in quality control, process material evaluation, and research and development for applications.

Photoluminescence Spectrophotometer (LAMBDA 45, Perkin Elmer, 2013)

- Quantification of heavy metals (nanomaterials) in freshwater, seawater, air, and soil.
- Soil contamination from organic materials.
- Sunscreen efficacy.
- Water and wastewater analysis.

Potentiostat-Galvanostat (CHI660E, CH Instruments, USA, 2013)

- General purpose electrochemical measurements
- Kinetic measurements
- Electroanalysis
- Fundamental research
- Corrosion
- Battery studies.

Rheometer (Model C-LTD80/QC, Anton Paar GMBH,Austria, 2013)

- Viscosity measurement – From single point up to complex rheological tests
- Quick and accurate temperature control
- Ease of operation for single-point viscosity determinations as well as more sophisticated rheological tests
- A wide range of applications covered by only one rotational rheometer
- A broad variety of measuring systems and accessories for a multitude of applications

Thermo mechanical Analyzer (TA Instruments-TMAQ400EM)

Intrinsic and product property measurements

- Accurate Co-efficient of Thermal Expansion
- Material performance
- Multilayer film analysis
- Shrinkage force testing
- Film tensile
- Fiber stress/strain measurement
- Thermal stress analysis fibers

GC-MS (CLARUS SQ8S, Perkin Elmer)

- Test for contaminants and quality in food, flavors and fragrances
- Monitor for VOCs and SVOCs in air, water and soil
- Ensure quality of consumer goods, including plastics
- Analyze lubricants for quality and conformity
- Meet global regulatory requirements
- Gain efficiencies in sample handling through an autosampler.

ISE Measurements (Orion Dual Star, Thermofisher)

- Quantification of
  - Monovalent cations and anions such as Fluoride, Nitrate, Nitrite, Ammonium etc.
  - Divalent cations and anions such as Copper, Lead etc.

pH/ORP, DO, CD/TDS, Turbidity Meter (YK-2005WA, TU-2016, Lutron)

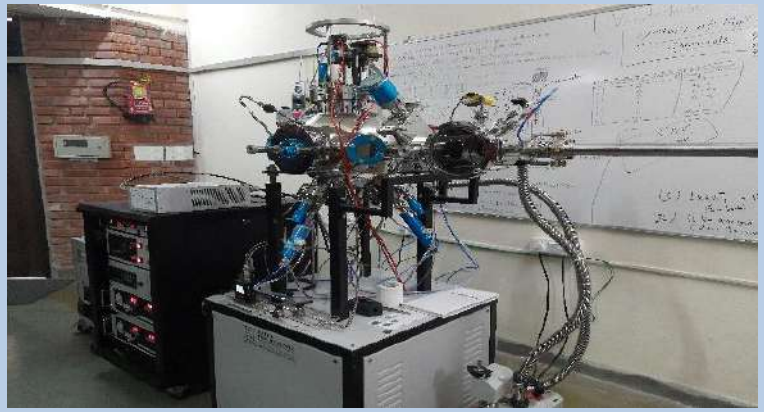
- One meter for multi purpose operation :PH/ORP, DO, CD/TDS METER
- pH : 0 to 14.00 pH, ORP : ± 1999 mV.
- Conductivity : 200 uS/2 mS/20 mS/200 mS.
- Dissolved oxygen : 0 to 20.0 mg/L.
- Turbidity: 0.00 to 50.00 NTU, 50 to 1,000 NTU

HPLC (Prominence I series, Shimadzu)

• High injection precision for precise quantification, and exceptional retention time repeatability aid in accurate peak identification
• Detection capabilities include photodiode array, refractive index

Colony Counter (SCAN 4000, Interscience)

• Ultra HD automatic colony counter
• Inhibition zone reader for reading of colonies
• Higher accuracy and compactible with all sizes of petri dishes and media
• Digital zoom x 69
• Resolution: 5 megapixels
• Counting time: up to 1000 colonies per second



SPUTTERING SYSTEM (Excel Instruments)

Thin antireflection coatings on glass for optical applications are also deposited by sputtering. Because of the low substrate temperatures used, sputtering is an ideal method to deposit contact metals for thin-film transistors. Another familiar application of sputtering is low-emissivity coatings on glass, used in double-pane window assemblies. The coating is a multilayer containing silver and metal oxides such as zinc oxide, tin oxide, or titanium dioxide. A large industry has developed around tool bit coating using sputtered nitrides, such as titanium nitride, creating the familiar gold colored hard coat. Sputtering is also used as the process to deposit the metal (e.g. aluminium) layer during the fabrication of CDs and DVDs.

Raman Scattering

- *based on the Raman scattering where the lower frequency photons are pumped to a high-frequency regime with a surplus amount of energy.*
- *works on the basis of Raman effect and finds applications in various fields like in nanotechnology to understand the structure of nanowires, in biology and medicine where the low-frequency DNAs and proteins are studied and chemistry to understand the structure of molecules and their bonds.*
- *used in remote sensing and planetary exploration.*
- *used to sense the minerals in Mars.*

Three-zone CVD furnace (VB ceramic consultants)

Continuous operating temperature: 1000^{O}C max,
element temperature: 1250^{O}C max,
rate of heating: 5^{O}C/min max,
thermocouple K type, water chillar 50 L,
furnace actual current rating 5 amps

Tubular Furnace (Acmas Technologies Pvt. Ltd.)

Continuous operating temperature: 1100^{O}C max,
maximum temperature: 1200^{O}C max,
working power 1.5 KW,
rate of heating: ≤10^{O}C/min max,
thermocouple K type,
heating element: high quality Fe-Cr-Al-Mo electric wire

*Spin coating system (*SpinNXG-P2/APEX Instruments*)*

Speed range: 100 to 10,000 rpm
Acceleration: 40 to 5000 rpm/sec
Duration: 1 - 9,999 sec/step
≤ ±1 % error across the full range speed
N2 and other gas purging port
Teflon coated working chamber

*Thermal Evaporation System (*Excel Instruments*)*

Consist of chamber,
electrode assembly,
substrate heater with temperature controller,
gate valve,
gas flow assembly,
thickness monitor,
filament power supply

*Muffle furnace (*Nabertherm*)*

Maximum Temperature 1200 degree C
Volume 5 L
Heating time 60 Minute

*Source Meter (*KEITHLEY*)*

V ranges 20 mV – 200 V
I ranges 10 nA – 1 A
Accuracy 0.012 % basic
Wide band noise 2 mVrms
Sweep types: Linear, log, dual linear, dual log, custom

*Laser cutter engraver (*CW-6040*)*

Lasing system = CO2 laser tube (λ = 10.6 µm)
Laser power = 100 W
Cutting speed = 0 – 800 mm/s
Engraver speed = 0 – 1000 mm/s
Spot size = 50 µm
Working area = 2’ x 1.5’
Substrate possibilities = acrylic, MDF, cellulose sheet, Kapton sheet etc..

*3D printer (*COLIDO X 3045*)*

Extra large build size: 11.8”x11.8”x17.7” (30x30x45 cm),
clean and easy to use,
industrial level quality & smooth building surface – up to 0.1 mm resolution,
stable & quite

*Electrochemical Workstation (*Autolab M204*)*

Potential range: -10 V to +10 V,
compliance voltage range: ±20,
maximum current in ampere: ±0.4,
Number of current ranges: 8,
number of current ranges remark: 10 nA to 100 mA,
maximum number of modules: 1,
maximum number of channels: 12,
Potential & current accuracy: V: ±0.2% ±0.2mV and i:±0.2 % ±0.2% of current range,
potential resolution: 3µV (gain 100),
current resolution: 0.0003% of current range,
maximum bandwidth in Hz: 1M,
Input impedance in Ohm: 100 G

*Optical microscope with digital camera (*Magnus MSZ-TR*)*

Light source: LED,
camera casing: metal alloy,
camera dimension: 60x60x40 mm,
spectral range: 380-650 nm with IR filter

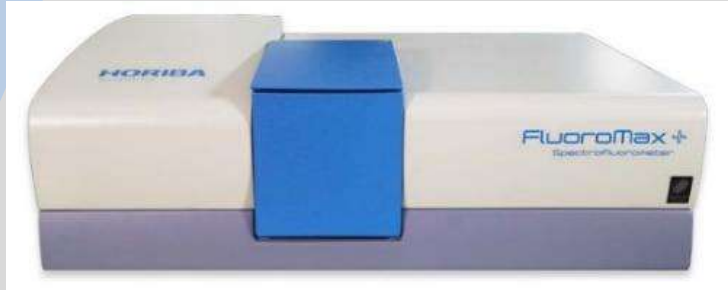
*TGA DSC (*Inkarp*)*

Thermogravimetric Analysis can track the changes in the mass of your sample as the temperature is changed in a controlled manner. Analysis typically consists of monitoring the mass of your sample while heating at a constant rate, or held at a constant temperature over time.

Differential Scanning Calorimetry can track the changes in the heat flow to and from a sample as the temperature is changed in a controlled manner. The sample may be subjected to some heating and cooling cycle(s) in an inert or oxidizing environment. Each of these cycles may provide different information.

Fluoroscence Spectrometer *(*Fluoromax plus C P*)*

A fluorescence spectrometer is a device to detect and analyze organic compounds. Used in biology, chemistry, and environmental science laboratories, the fluorescence spectrometer measures the fluorescence of a molecule to gather information about its components and chemical environment.



*Screen Printer (*Dashmesh Print Line*)*

Printer type: Semi-automatic flat screen
Resolution: 0.5 mm
Maximum printing area: 18” x 24”
Substrate alignment: Vacuum suction technology
Substrate choices: Cellulose paper, silk, cotton
Few applications: Printed/flexible/wearable electronics, microfluidic sensor

*XRD (*Malvern Pananalytic*)*

In GIXRD, the incident angle of the X-ray beam hitting the sample is adjusted relative to the critical angle of the reflected X-rays in the same way as in X-ray reflectivity, with which the structural properties of thin films can be determined. The critical angle of the reflected X-ray beam is unique for every material and is generally very small.
The higher the incident angle relative to the critical angle of the material, the deeper the X-rays go down into the material. Therefore, if the incident angle of the X-rays rises above the critical angle, the depth of the penetrating X-rays increases rapidly. When the incident angle is smaller than the critical angle, the X-rays go through the sample only a few nanometers.

Glove box

A glove box is a sealed container that is designed to allow one to manipulate objects where a separate atmosphere is desired. Built into the sides of the glove box are gloves arranged in such a way that the user can place their hands into the gloves and perform tasks inside the box without breaking containment. Part or all of the box is usually transparent to allow the user to see what is being manipulated.

Areas of Expertise

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Biofuel

- Additives Development and Testing
- Endurance Analysis
- Blending optimization
- IC Engine Research
- Plastic waste to Fuel
- Waste to Fuel
- Algal based Biofuel
- And related areas

Solar

- Plant Design
- Pyrolizers
- Cooling Devices
- Efficiency Analysis
- Measurements
- And related areas

Water

- Treatment
- Shedding
- Management
- Treatment Plant
- Sludge Management
- Development of Filtration Units
- Development of Adsorbents
- Cost Effective Water Treatment Devices
- And other related areas

Energy

- Auditing
- Optimization
- Analysis
- Modelling
- And related areas

Management

- Supply Chain
- Policy Frameworks
- Sustainability

UPES has experts in multidisciplinary domains, for more areas of expertise please visit
www.upes.ac.in

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Online Sample Analysis Requisition:

https://docs.google.com/forms/d/e/1FAIpQLSf_z_Dw6OAjglUBrs1MxG4XHbcAsEI8M4PeqAS4ynCAvrvPaw/viewform?pli=1

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