



CENTER FOR MATERIAL SCIENCE (CMS)
KLE Technological University

Vision

The Material Science Cluster will be recognized in education, research and consultancy in **composites and nano-materials** by industries, peers at academic institutions and will be a source of research expertise, technical innovation and product development.

Mission

- To develop research facilities for synthesis, characterization and testing of composites.
- To foster capacity building of researchers and promote collaborative works.
- To develop composites and nano-composites for structural, automotive and energy engineering applications.
- To facilitate interdisciplinary and applied research with a focus on innovative product development.

About Centre for Material Science

Centre for Material Science mainly caters to research and development activities in the area of Nano-materials, Nano-composites for various engineering applications like structural, energy, biotechnology and agricultural sectors. The centre has several funded projects and state-of-the-art facilities to carry out innovative research in material science. Establishment of clean room facility of class 10000 for dedicated nano-fabrication facilities exist.

Research facilities:

- Class 10,000, grade C- Cleanroom
- Chemical Vapor Deposition (CVD)
- PVD-Thermal evaporation unit, RF Magnetron Sputtering
- Hall effect measurement system
- Probe Sonicator
- Spin coater
- Wear & Friction monitor Model-20LE Ducom Instruments
- 8” Double Disc Variable Speed (Chennai Metco)
- General Purpose Grinder (Chennai Metco)
- Trinocular Vertical Metallurgical Microscope



- Chemical Fume
- Pervaporation Set up
- Keithley 6517B High Resistance Electrometer
- Universal Testing Machine
- Physical Vapor Deposition
- Radiator and Heat Exchanger test rigs



Chemical vapor deposition (CVD)

Make: VT Vacuum Bangalore

- Tube Furnace with Max temp-1200° C with vacuum
- Gas Mixing and delivery System
- Mass Flow Controller: Power Supply - 247 D to M 100B
- Calibrated for Ammonia (NH₃), Nitrogen(N₂), Argon (Ar)
- 247 D Four Channel Mass Flow Controller Power Supply
- Agilent make Rotary Vane Pump DS:302

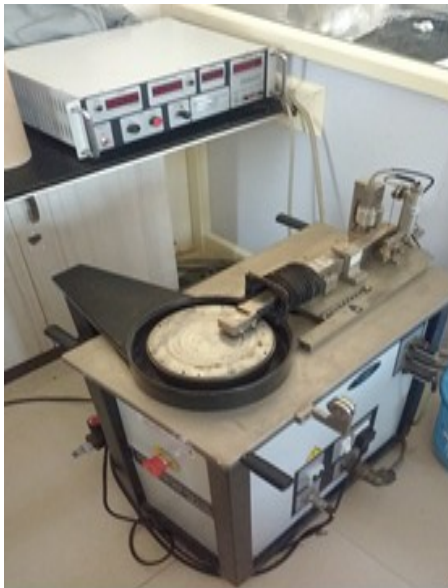


Thermal Physical Vapor Deposition (PVD)



Make: Vacuum Techniques Bangalore

- Vacuum Chamber :400mm(W) x 400mm (D) x 400mm(H)
- Rotary Vacuum Pump and Diffusion Vacuum Pump
- Liquid Nitrogen Trap
- High Vacuum Valve
- Digital Pirani and Penning Gauge



Wear & Friction monitor (Model-20LE)

Make: DUCOM Instrument

- Wear Disc Diameter: \varnothing 165 mm
- Pin Diameter and Ball Diameter
- Wear Track Diameter
- Disc Speed: Min 200 - Max 2000Rpm





- 1) General Purpose Grinder
- 2) 8" Double Disc variable Speed
- 3) Trinocular Vertical metallurgical Microscope, Plain Optics & Incident Light illumination, Chennai Metco.



Probe Sonicator (Anamatrix Instruments)

- Power:250 W Advanced and Frequency: 20KHz
- Display temperature control
- Overload Protection
- 10 operation Programs
- Probe Diameter :¼" (6mm)



Programmable Spin Coating System

(Apex Instruments)

- Oil free Vacuum Pump
- Delrin Substrate Holders
- Inert Gas Purging port (Nitrogen)



Hall Effect measurement (Ecopia Corporation)

- Model: HMS - 3000/MS55T
- Spring Clip type sample Board



PVD - RF/DC and Thermal Sputtering

Specifications

DC sputtering (DC Power supply model PS-1000)

Applied voltage: 0-1000

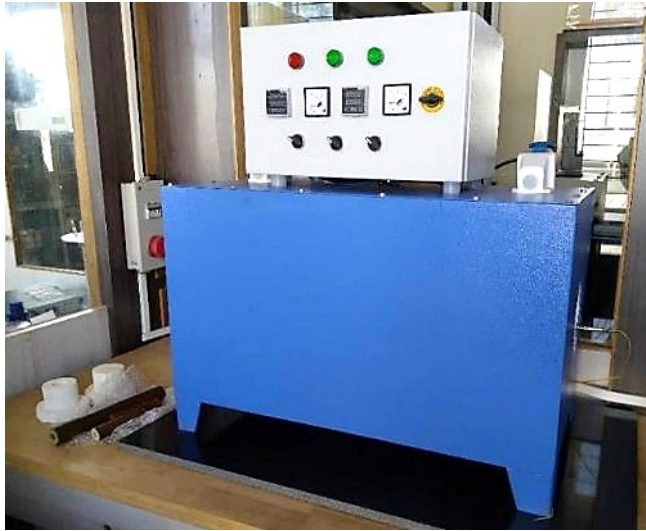
Cathode assembly: 2 inches

Rf sputtering (AG plasma Series RF generator)

RF power out output: 0-300 w

Cathode assembly: 2 inches

1. Reactive gases: Oxygen and Nitrogen
2. Sputtering gas: Argon
3. Substrate temperature: up to 400 °C
4. Substrate rotation



Chemical Vapor Deposition

1. Two zone furnaces
2. Programmable Temperature varies from room temperature to 1000 °C



Probe station with R-T Measurement system

Specifications (Make: 6517b Electrometer/ High Resistance Meter)

1. Build in voltage source up to 1000 V
2. Voltage measurements up to 200 V
3. Measures Resistance from 1 to 10^{18} Ohm
4. Current measurement 10 aA to 20 Ma
5. Charge measurement: 1fC to 2 μ C
6. Substrate temperature varies from room temperature to 450 °C



UTM, Model 10 ST

Features

- Suitable for tension, compression, flexure, shear and other tests to a maximum force of 10kN / 2,000 lbf
- Various system interface options available, from a familiar tethered handheld interface, a wireless Bluetooth interface panel, or virtual machine controller
- All interface options integrate with Horizon data analysis software
- Meets or exceeds the requirements of national and international standards for materials testing systems
- 8 full-length T slots built into machine column to allow accessories to securely mounted to the test frame
- Built-in pneumatic distribution ports that provide local air supply to pneumatic grips

Membrane Technology Laboratory (VGST sponsored)



Fourier Transform Infrared Spectroscopy

Make: PerkinElmer, Spectrum Two FT-IR Spectrometer

Specifications



- 21 CFR Part 11 Compatible Yes
- Depth 30.0 cm
- Detector Type DTGS
- Height 21.0 cm
- Operating Range 5 - 45 °C
- Portable Yes
- Product Brand Name Spectrum Two
- Wave Length 8300 - 350 cm⁻¹
- Weight 13.0 kg
- Width 45.0 cm



Pervaporation setup

It is used to remove moisture from alcohols using membrane technology



Karl Fischer Titrator (KAFI)

Make: Labindia

Features



- Advanced Microcontroller based user-friendly, state-of-the-art product design with User interactive software for ease of operation with protection against invalid entries.
- Quick interchangeable imported burette assemblies with intelligent recognition for its volume size. Burette validation factor for dispensing correction is available for true end point volume.
- System recognizes proper connectivity of other peripherals like Burette, Stirrer, Electrode, Pen Drive etc. Gives indication in case of improper connectivity.
- Large memory capacity for method storage with suitable scientific parameters having GLP compliance.
- Sample Name & Identification Number with Date and Time for authentication. Daily Auto Incremented Run number and Factory entered CUSTOMER NAME & Instrument Sr. No. on report printouts make the system foolproof and GLP compliant.
- Quick monitoring, and automatic neutralization of moisture leak into vessel to keep it ready for next titration.
- End point delay up to 100 sec for slow moisture releasing samples.
- On line leak rate correction available.
- Microcontroller based variable speed, magnetic stirrer with digital indication.

UAS Dharwad sponsored



Contact angle meter

Make: Apex instruments



Make: Acam Series Features

- Stage Heating Module: Up to 200°C by Heating Jacket Module or by Liquid Circulating Jacket Module
- Stage Movement Module: Movement of Substrate Stage in XZ Directions or XYZ Directions
- Zoom Lens Module: Zooming Facility up to 10X
- Auto-dispensing Module: Liquid Dispensing with a Programmable Volume & PC-controlled Dispensing Speed Range of 0.038 - 16 µl/sec.

Details of Publications

- Journals: 140
- Conference proceedings: 50

Details of Patents

| Sl. No | Financial Year | Title of Patent | Patent Application No. | Inventors Type | Current Status |
|--------|----------------|---|------------------------|---|------------------|
| 1. | 2015-16 | Nano-composite coatings for Tribological applications | 2182/CHE/2015 | Shankar A. Hallad N. R. Banapurmath Arun Y. Patil Anand M. Hunashyal Ashok S. Shettar | Online Published |
| 2. | 2015-16 | Nanocomposites for cutting tool tip | 4628/CHE/2015 | Shankar A. Hallad N. R. Banapurmath Arun Y. Patil Anand M. Hunashyal Ashok S. Shettar | Online Published |
| 3. | 2016-17 | Nano ceramic coating for cement composites | 201641034228 | Shankar A. Hallad N. R. Banapurmath Anand M. Hunashyal Sreelekshmi B. Shridevi H. Ashok S. Shettar | Online Published |
| 4. | 2016-17 | Potash Alum Reinforced in Epoxy Resin | 201614002919 | Shankar A. Hallad N. R. Banapurmath Anand M. Hunashyal Chetan Kulkarni Ashok S. Shettar | Online Published |
| 5. | 2017-18 | Synthesis of Nano-Coolant | 201641034226.00 | Shankar A. Hallad N. R. Banapurmath Anand M. Hunashyal Akshay P. M Ashok S. Shettar | online Published |
| 6. | 2017-18 | Ceramic Membrane filtration | 201641034227 | Shankar A. Hallad N. R. Banapurmath Anand M. Hunashyal Ashok S. Shettar | Online Published |



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| 7. | 2019-20 | Ceramic nanocomposite for nuclear radiation shielding application | 201941038623 | Shankar A. Hallad N. R. Banapurmath Anand M. Hunashyal Ashok S. Shettar | Online Published |
| 8. | 30 November 2019 (2019-20) | Biodegradable Polymer Blend Films, Method and Process For Production Thereof | 201941049309 | Dr. Ashok M. Sajjan Dr. N. R. Banapurmath Mr. Sharanappa Achappa Dr. Ashok S. Shetter | Filed |
| 9. | 01-08-16 | Ball Drying Apparatus | 5664/CHE/2015 | Mr. Arun Y. Patil Mr. Saurabh Bidari Dr. Nagaraj R Banapurmath Mr. Shankar Hallad Dr. Ashok S Shettar | FER Issued |

Funded projects

There are several fundings form state government agencies

- VGST, KFIST-Level II, Bangalore (40.0 Lakhs)- 2016-17, “Development of Novel Nano-composite hybrid polymer membranes for pervaporation separation of water from industrial waste organic solvents”, PI: Dr. Ashok M Sajjan
- VGST, KFIST-Level II, Bangalore (40.0 Lakhs)- 2013-17, “Synthesis and Characterization of group III- nitride nanostructure based FET for bio-chemical sensing applications”, PI: Dr. N. H. Ayachit and Dr.N .R. Banapurmath.
- VGST, SEED MONEY TO YOUNG SCIENTIST FOR RESEARCH (SMYSR) (Rs. 4 Lakhs) Synthesis of Ag and Au-coated III nitride nanostructures for biochemical sensing applications PI: KISHOR UPADHYAYA
- VGST, KFIST-Level I, Bangalore (20.0 Lakhs)- 2012-13, “Establishing the facility for nanotechnology for structural and energy engineering applications”, PI: Dr. S. S. Quadri.

UAS Dharwad

- UAS, Dharwad (Rs. 4 Lakhs)- 2017-18, “Development of membrane filter technology for ethanol purification for fuel”, PI: Dr. A. M. Sajjan, Dr. N .R. Banapurmath and Dr. Geeta Shirnalli (UAS Dharwad).



- UAS, Dharwad 2nd Phase (Rs. 10 Lakhs)- 2016-17, “Development of membrane filter technology for increasing heat efficiency of biogas for power generation”, PI: Dr. N.R. Banapurmath, Dr. A. M. Sajjan and Dr. Geeta Shirnalli (UAS Dharwad).
- UAS, Dharwad 1st Phase (14.55 Lakhs)- 2015-16, “Development of membrane filter technology for increasing heat efficiency of biogas for power generation”, PI: Dr. N.R. Banapurmath and Dr. A. M. Sajjan.

Startup funding

- IDEA2POC-Startup Grant from GOK (Rs. 25 Lakhs)- April 2017, “Economical production ecofriendly bioplastic for packaging segment”, PI: Dr. Jayachandra S. Y.