



നാഷണൽ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഓഫ് ടെക്നോളജി കാലിക്കറ്റ്  
राष्ट्रीय प्रौद्योगिकी संस्थान कालीकट  
NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

# SCHOOL OF MATERIALS SCIENCE AND ENGINEERING





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The School of Materials Science and Engineering ( Formerly School of Nano Science and Technology ) at National Institute of Technology Calicut offers programs at the Bachelors, Master's and Doctoral levels, in various academic streams related to Materials Science and Engineering

### **B Tech in Materials Science and Engineering (Intake : 30)**

The program is a four year bachelor's degree in technology, offered by School of Materials Science and Engineering, with an emphasis on rapidly developing energy, polymer, bio and nano materials. This is an interdisciplinary program that make use of knowledge from chemistry, physics, biology and mathematics combined with the principles of mechanical, chemical and electrical engineering.

### **M.Tech in Materials Science and Engineering (Nanotechnology) (Intake : 16)**

The programme is designed for students with a background in Mechanical/Production/Chemical Engineering. This will deal with topics related to the fundamentals and applications of the subject, with a focus on emerging areas in Nanoscience and Nanotechnology.

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Equipment Details

## SEM CENTRE

The centre is equipped with Hitachi SU6600 Variable Pressure Field Emission Scanning Electron Microscope (FESEM) for producing images of a sample by scanning the surface with a focused beam of electrons.

- Characterization of samples for applications including Nanoscience and Technology, Materials Processing, Biosciences and Medical Applications, Polymers and Ceramics, Alloys and Gels

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### SU 6600 -FESEM

- Electron gun: Tungsten Schottky emission electron source
- Resolution: 1.2 nm/30 kV, 3.0 nm/1 kV
- Probe current: 1pA~200nA
- Specimen chamber pressure:  $10^{-4}$ Pa (high vacuum), 10~300Pa (low vacuum)
- Specimen Size: Max 150 mm dia. ×40 mm H
- Magnification: 500,000 x



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Equipment Details

## SPM CENTRE

The centre is equipped with Park XE-100 Atomic Force Microscopy (AFM).

Supported Modes

- ❑ True Non-Contact Mode and Contact Mode
- ❑ Force - distance Spectroscopy/F-d volume imaging
- ❑ Phase imaging of True Non-Contact, FMM, MFM and EFM
- ❑ Conductive AFM and Scanning Tunneling Microscopy
- ❑ Magnetic Force Microscopy and Electric Force Microscopy
- ❑ Scanning Thermal Microscopy
- ❑ Nanolithography and Nanoindentation

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### SPECIFICATIONS:

- ❑ Decoupled XY & Z Scanners
- ❑ Scan range of XY-scanner: 5  $\mu\text{m}$  and 100  $\mu\text{m}$
- ❑ Working distance of Z-scanner: 12  $\mu\text{m}$  or 25  $\mu\text{m}$
- ❑ Sample size: Up to 100 mm  $\times$  100mm, 20 mm thick, and up to 500 g



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Equipment Details

## FOURIER TRANSFORM INFRA RED SPECTROMETER (FTIR)

FTIR spectrometer with advanced sampling accessories for analyzing wide variety of samples

- ❑ Transmission mode accessories with KBr die and Pellet press
- ❑ Universal ATR accessory with diamond crystal
- ❑ Diffuse reflectance accessory
- ❑ Variable angle specular reflectance accessory

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- ❑ **Make: Perkin Elmer Frontier MIR Operating**
- ❑ **Range: 8300  $\text{cm}^{-1}$  -350  $\text{cm}^{-1}$**



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Laboratories Details

## DC - MAGNETRON SPUTTERING UNIT

DC – Magnetron sputtering is a thin film Physical Vapor Deposition (PVD) Coating technique.

Widely used for thin film metal electrode coatings in device fabrication.

- ❑ Instrument is equipped with 2-inch flexible magnetron source
- ❑ Magnetron is compactable with DC and RF power supply
- ❑ Magnetron source is in the sputter up/down configuration
- ❑ Different 2-inch metal targets can be placed
- ❑ Equipped with substrate heater
- ❑ Available targets – Aluminium and Chromium

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- ❑ **Make: Hind high vacuum (HHV)**
- ❑ **Model: 12 –MSPT**



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Laboratories Details

## GLOVE BOX

A glove box is a miniature statue of a clean room facility, useful for the synthesis of different materials at inert environment as well as it is providing an inert and clean atmosphere for device fabrication. Experimental works involving a high risk of contaminants and stability issues of the chemicals involved when exposed to the atmosphere can be carried out in glove box.

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- ❑ **Make: Jacomax**
- ❑ **Model: Jacomax GP (Concept)**



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Equipment Details

## SOURCE METER

Source Meter source measure unit (SMU) instrument can measure current, voltage, and resistance. Well-suited for characterizing modern scaled semiconductors, nano-scale devices and materials, organic semiconductors, printed electronics, and other small-geometry and low-power devices.

- ❑ Five-inch, high resolution touch screen.
- ❑ Sensitivity with new 20mV and 10nA source/measure ranges.
- ❑ Four “Quickset” modes for fast setup and measurements.
- ❑ Front panel input banana jacks; rear panel input triaxial connections.
- ❑ Front panel USB memory port for storing data, programming, instrument configurations, and to upgrade the unit.
- ❑ Computer interface with KickStart software.

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**Make: Keithley- Tektronix Company**

**Model: 2450 Source Meter SMU  
Instrument**





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Laboratories Details

## NANOSCIENCE RESEARCH LABORATORY (NSRL)

This lab is developed with the funding of DST, DBT, CSIR, KSCSTE, & SERB. The research mainly focuses on the application of nanomaterials in clean energy and health care.

### Major Equipments:

- ❑ Electrochemical Workstations
  - ❑ CHI 760E –funded by KSCSTE
  - ❑ *Metrohm Multi Autolab M204*-funded by DST & SERB
- ❑ Trinocular Research Microscope
  - ❑ *Olympus BX51* –funded by DBT

\*All research works are carried out using the above-mentioned instruments.

## SCHOOL OF MATERIALS SCIENCE AND ENGINEERING



### Major Research Areas:

- ❑ **Biosensors**  
Development of biosensors for the detection of biomolecules.
- ❑ **Energy Generation, Conversion and Storage.**  
Development of catalysts for HER, OER, ORR and Battery applications.



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## NANOMATERIALS AND DEVICES RESEARCH LABORATORY (NDRL)

This Laboratory aims at the synthesis and characterization of liquid crystal polymers, development of polymer nanocomposites for future memory applications, Piezoelectric devices, Design and fabrication of sensors based on MEMS/NEMS technology.

### Major equipments:

- ❑ Spin coater (*SPS 150*)
- ❑ Vacuum and Hot air Oven
- ❑ Probe sonicator (Sonics) and ultrasonicator
- ❑ Magnetic stir with hot plate (*IKA*)
- ❑ Optical microscope (*Labovision KX POL*)
- ❑ Electrical and frequency characterization equipment's (*DSO:TBS 2000 SERIES*)

## SCHOOL OF MATERIALS SCIENCE AND ENGINEERING



### Major research areas

- ❑ **Energy harvesting and storage**

Synthesizing and fabricating polymer-based piezoelectric devices for energy harvesting applications

- ❑ **Gas sensors**

Fabricating SAW and resistive-based sensors for gas sensing applications



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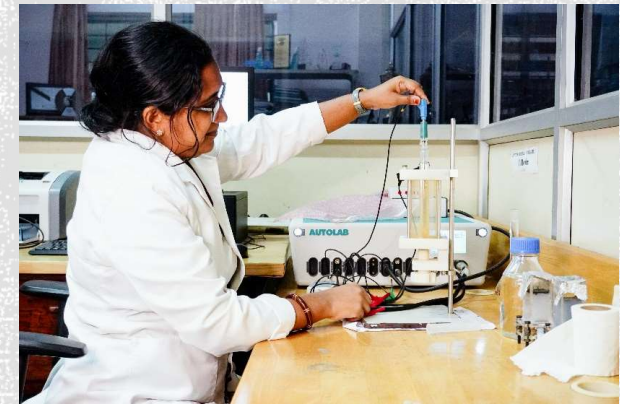
## APPLIED NANO ENGINEERING LABORATORY

This lab encompasses research mainly focused on the application of nanoengineering materials and is actively involved in industry-oriented collaborative research on the synthesis and development of nanoengineered materials based on phase change materials, 2D materials and heterostructures, metal oxides and biodegradable polymers for potential engineering applications.

### Major Equipments:

- ❑ Electrochemical workstation – (*Metrohm Multi Autolab*)
- ❑ Dynamic light scattering (DLS)- (*Malvern Zetasizer*)
- ❑ Freeze dryer(*Penguin classic*)
- ❑ Vacuum and Hot air Oven
- ❑ Spin coater (*Holmarc, Ho-TH-05ST*)

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### Major Research areas:

- ❑ **Thermal management of devices**  
Interferometry studies, Thermal energy storage using PCM, Electronic/ Battery cooling,
- ❑ **Corrosion and tribology**  
Solid lubricant coating
- ❑ **Biofouling**  
Biofouling inhibitive coatings



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## MICRO/NANO ENGINEERING RESEARCH LABORATORY (MNERL)

The research in this lab is supervised by Prof. C. B. Sobhan and Dr. Shijo Thomas on the prime areas of research like green energy, Carbon dioxide storage and conversion and Thermal management systems.

### Major Equipments:

- Chemical Vapour Deposition unit
- Thermal evaporation unit (*High Vacuum Products and Instruments*)
- Solar simulator (*Holmarc, 300W Xenon lamp*)
- Photocatalytic reactor (*Lelesil Innovative Systems, 300W Xenon Lamp, 250W UV&Vis lamps*)

## SCHOOL OF MATERIALS SCIENCE AND ENGINEERING



### Major Research areas:

- Energy conversion and storage**

Photothermal conversion using nanofluids, Photocatalytic water splitting, CO<sub>2</sub> capture and conversion using ionic fluids

- Thermal management**

Interferometry studies, Thermal energy storage using PCM.

- Simulation** - Molecular dynamics



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Laboratories Details

## APPLIED MATERIALS RESEARCH LABORATORY (AMRL)

The AMRL team includes interdisciplinary researchers with expertise ranging from Mechanical, Materials, Nanotechnology to Biomedical Engineering. Currently, we focus on biodegradable metallic implants, neuromodulation, metal nanoclusters, and electrospinning for biomedical applications.

### Major Equipments:

- Metallurgical Microscope – *Radical (model – RXLr-4M)*
- -86 °C Ultra low-temperature freezer – *Being (model-BDW-86L390)*
- Abrasive cut-off machine – *Radical (model-RACM-55)*
- Double disk polishing machine – *(Bainpol – Metco)*
- Belt finishing machine – *Bainline - Chennai Metco*
- Stir casting furnace - *Nano Tec*

## SCHOOL OF MATERIALS SCIENCE AND ENGINEERING



### Major Research Areas

- ❑ **Biodegradable Metallic Implants**
- ❑ **Neuromodulation**
- ❑ **Metal nanoclusters**
- ❑ **Electrospinning**
- ❑ **Medical Materials**



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## SEMINAR HALL



## Seminar Hall Details

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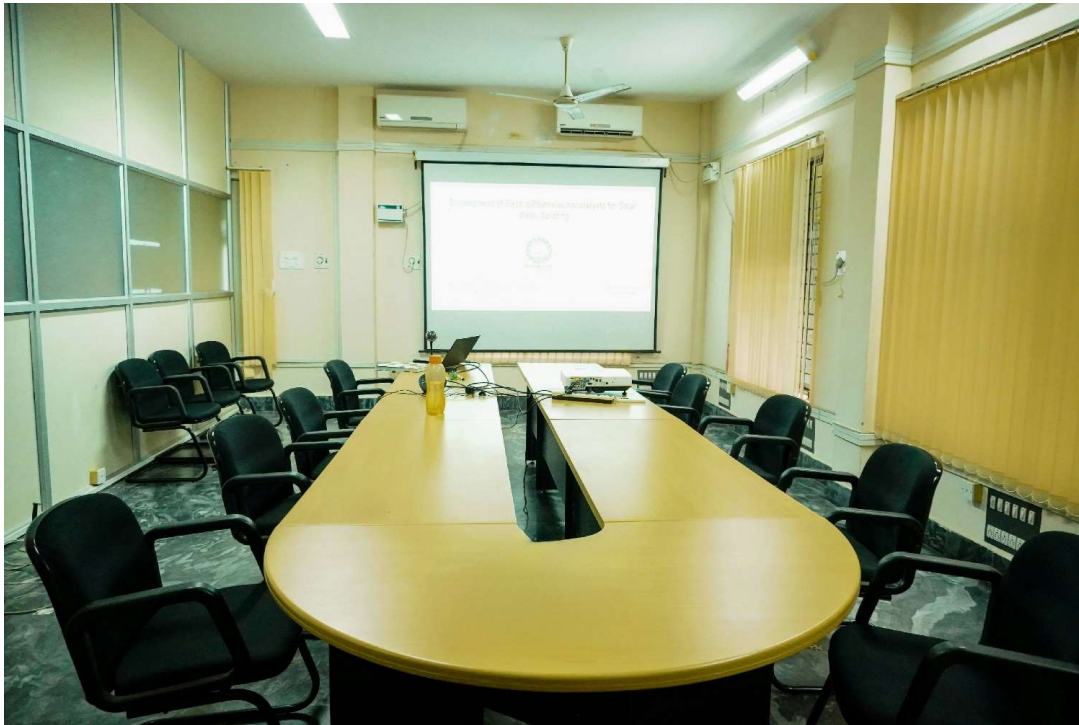


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Seminar hall Details

## CONFERENCE HALL



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**Team SMSE**