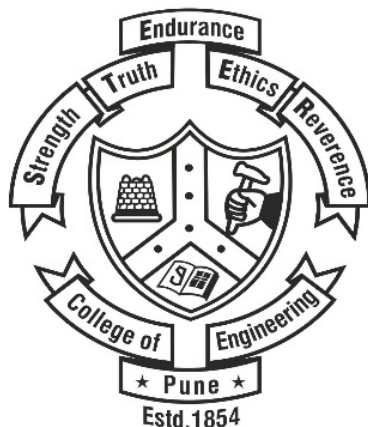




# DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE



**COEP**

**COLLEGE OF ENGINEERING PUNE**

**Information Booklet**

# DEPARTMENT OF METALLURGY & MATERIALS SCIENCE

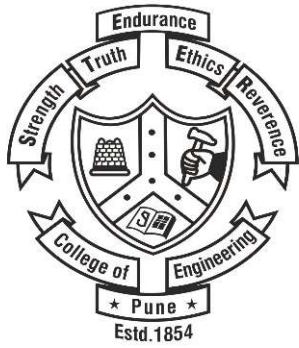
- The department of Metallurgical Engineering was established in 1948.
- The department is known in India for excellence in technical education research, and industrial consultancy.
- NBA Accredited B.Tech. and M.Tech. Programs. Department also offers Ph.D. program.
- Faculty members with their academic research and consultancy activities in various areas of materials engineering and technology science.

## VISION

- To be Value based globally recognized Metallurgy and Materials Technology Department imbining academic excellence in research and development, innovation and entrepreneurship.

## MISSION

- To impart students the highest quality knowledge base and skill set of the fundamental and applied concepts in Metallurgy and Materials Technology towards achieving globally competent professional excellence.
- To inculcate in students the capability of offering technical support to the Industry, Entrepreneurial Attitude, Research and Development, Innovation and the adaptability for the changing modern technologies.
- To cultivate values, creativity, innovation, productivity in students and build an awareness of societal and national responsibilities necessary for the development of the individual, society, and the country.



**COEP**

# DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE COLLEGE OF ENGINEERING PUNE-05



- ***Open to outsiders on chargeable basis for testing and characterization work***

# Material Characterization

## X-Ray Diffraction (XRD) Bruker, D8 Advance with Davinci Design



- Fully equipped lab with XRD machine (**Bruker, D8 advance**) **with davinci design** for characterization and analysis and use for
- Phase Identification
- Crystalline size measurement
- Residual Stress measurement
- Retained austenite measurement
- Profile fitting
- Quantitative Analysis
- Smallest increment: 0.0001°
- Sample Size: Powder 5 gm; Solid sample :dia. & thick < 5 cm

## Field Emission Scanning Electron Microscopy (FE-SEM) (up to 80000 X), Carl Zeiss



- FE-SEM, (Carl Zeiss, Sigma 40) use for
- Failure analysis
- Investigation of defects
- Surface topography
- Elemental analysis (EDS)
- Microstructural analysis of inclusion & others
- HAZ in weld metals
- High resolution images of ferrite, pearlite, martensite, austenite etc.
- Resolution: 1 nm or better @ 30 KV or 1.5 nm or better @ 15 KV or 3 nm or better @ 1 KV
- Record images from 15 X to 8,00,000 X magnification
- Sample Size: 15 x 15 x 15 mm max, Powder 1 gm max

# Advanced Material Technology Lab.

## FTIR (Fourier Transform Infrared Spectroscopy) 4100, JASCO



- Fully equipped lab with FTIR (Fourier Transform Infrared Spectroscopy) 4100, JASCO use for
- Structural analysis of matrix and composite
- Identification of unknown compounds
- Quantitative information like additives or contaminants
- Kinetic information through the growth or decay of infrared absorptions
- failure analysis
- Measurement wave number range 7,800 to 350  $\text{cm}^{-1}$
- Wave number accuracy: Within  $\pm 0.01 \text{ cm}^{-1}$
- Resolution:  $0.9 \text{ cm}^{-1}$

## UV spectrophotometer, V630, JASCO



- UV spectrophotometer, V630, Jasco use for chemical analysis
- Quantities and qualitative analysis
- Detection of impurities,
- Wavelength range: 190 to 1100 nm
- Wavelength accuracy:  $\pm 0.2 \text{ nm}$  (at 656.1 nm)
- Wavelength repeatability:  $\pm 0.1 \text{ nm}$
- Photometric range:  $\pm 10000 \%T$ , - 2 to 3 Abs

## DSC TGA, Linseis STA 1600 ,(up to 1000°C)



- Linseis STA 1600 use for simultaneous changes of mass (TG) and caloric reactions (HDSC) of a sample
- Temperature:  $-150^{\circ}\text{C}$  up to  $1600^{\circ}\text{C}$
- Sample size :dia . 4-6 mm, length - 10-50 mm, mass- 5 to 50 g,
- Resolution : $0.025\ \mu\text{g}$
- Vacuum:  $10^{-5}$  mbar

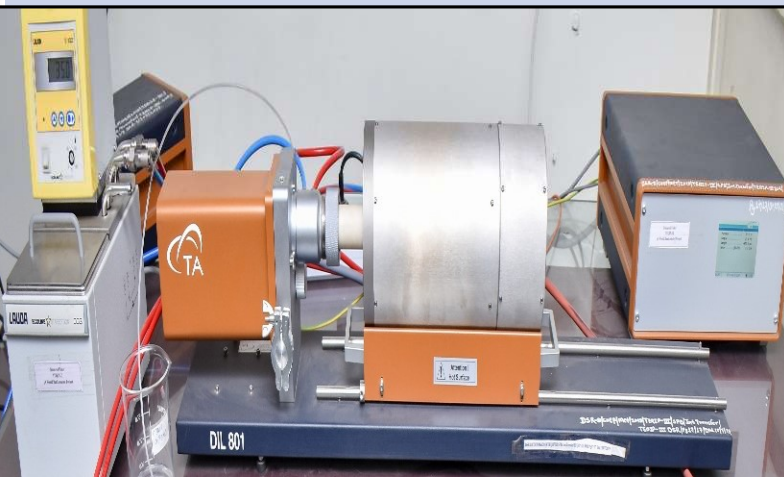
- Caloric reactions (HDSC) include
- Enthalpy,
- Melting energy
- Specific heat
- Glass point
- Crystallinity
- Reaction enthalpy
- Thermal stability
- Oxidation stability
- Aging and Purity
- Phase transformation

## BET Surface Analyzer



- Use for surface area measurement of minerals, powdered metals, organic materials etc.
- Range :  $0.1 \text{ m}^2/\text{gm}$ - $2500 \text{ m}^2/\text{gm}$
- Reproducibility : Better than  $\pm 3\%$
- Accuracy : Better than  $\pm 5\%$
- Analysis Time : Around 10-15 minutes/sample

## Dilatometer-801 , TA Instruments



- DIL 801 TA Instruments use for dilatometric tests, under vacuum inert gas , air. for ceramics, glasses, metals, and polymers etc.
- Sample Size Solid  $< 1 \times 1 \times 1 \text{ mm}$   
Powder  $< 1 \text{ gm}$
- Temperature range: RT to  $1500^\circ \text{C}$
- Length Resolution: 10 nm
- Temperature Resolution:  $0.05^\circ \text{C}$
- Accuracy in  $\alpha$ :  $0.03 \times 10^{-6} \text{ K}^{-1}$
- Contact force: 0.02 to 1 N,

## Muffle furnace (up to $1700^\circ \text{C}$ ) Therelek



- Muffle furnace Therelek
- Temperature:  $1700^\circ \text{C}$
- Heating Elements: molybdenum disilicide ( $\text{MoSi}_2$ )
- Heating chamber:  $2500 \times 150 \times 150 \text{ mm}$  (L\*W\*H)

# Corrosion and Surface Protection Lab.

## Galvanostat/ Potentiostat Interface 1000 (Gamry)



- Use for testing of physical electrochemistry,
- Electrochemical corrosion
- Paint, coatings and sensors
- Current Range: 9 (10 nA - 1 A)
- Max. Current :  $\pm 1$  A
- Noise and ripple  $< 20 \mu\text{V rms}$
- Min. current resolution : 3.3 fA
- Impedance measurements: up to 1 MHz

## Cyclic Corrosion Test, Equilam

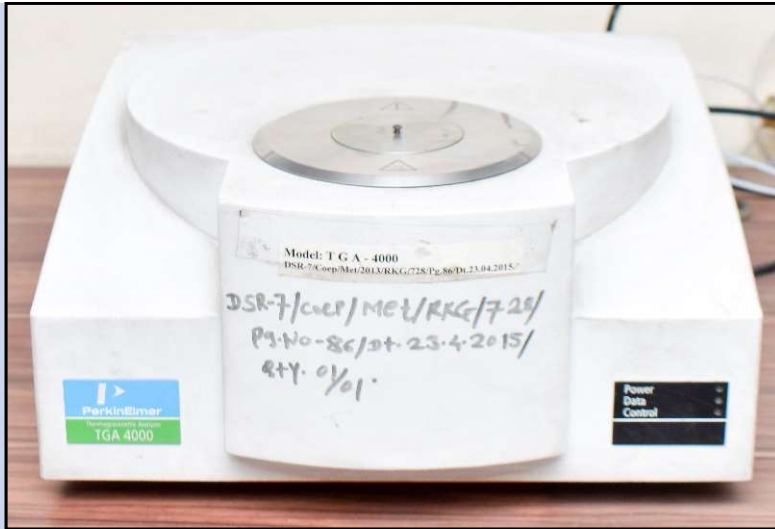


- Cyclic Corrosion Test , C.C.T – CORR Series, Equilam
- Mode: Salt spray(Salt Fog) Condensed humidity, Natural dry, dry off, spray, Climatization etc.
- Analysis of corrosion resistance of materials and surface coatings as per ASTM B117 – ASTM G 85 – ISO 9227 – JIS Z 2374 – DIN 50021
- Volume: 3000 L
- Temperature:  $5^{\circ} - 75^{\circ} \text{C}$
- Resolution of temperature controller:  $0.1^{\circ} \text{C}$ .



# Polymer and Composite Lab.

## TGA 4000, Perkin Elmer



- Use for Sample volatility, Moisture content, Oxidation stability, Decomposition temperatures, Carbon black content, Performance of stabilizers, Ash Content
- Temperature: 1000 °C

## Differential Scanning Calorimeter (DSC)Q20, TA Instruments



- DSC Q20(TA instruments) use for measure temperatures and heat flows
- Glass transitions, “cold” crystallization, phase changes, melting, crystallization,
- product stability, kinetics
- Temperature: RT to 725° C
- Accuracy +/- 0.1° C
- Precision +/- 0.05° C

## Universal Testing Machines (2T), Universal Motion Inc.



- Used for polymer and composites testing such as tension,
- compression,
- bend flexural
- Capacity: 2000 Kg
- Load accuracy: 0.2 % on full scale
- Distance between grips: 25-800 mm
- Least count: 0.1 Kgf/1Kgf

## Pin on Disc Wear testing M/C (Ducom)



- Analysis of wear resistance, Friction and tribological properties with or without lubricants
- Wear Measurement: 0 to 1200  $\mu\text{m}$
- Rotational Speed: 200 to 2000 rpm
- Load: Up to 200 N
- Frictional Force Measurement: up to 200 N

## Cryogenic Furnace



- Use for cryogenic treatment for various materials
- Temperatures : low as  $-185^{\circ}\text{C}$ , Liquid nitrogen bath with computerized control of thermal cycles.
- Capacity (bath):  $2*2*2.5$  Ft. (L\*W\*D)

## Sieve Shaker



- Sieve Shaker - Motorised RO-TAP, HS31.20 HEICO,
- Capacity: up to seven sieves of 200 mm dia.
- Mesh size 37 to 853 etc

# Metallographic and Microstructure Analysis

## Stereo-Microscope (25 X to 100 X)



- STEMI 2000C (Carl Zeiss, Germany) Use for
- Surface analysis
- Magnification: 25 to 100 X,
- Working Distance: 100mm,
- Bright and dark illumination
- Model: Axiovert 40 Mat (Carl Zeiss, Germany)
- Magnification: up to 500 X

## Laser Material Processing laboratory



- 400 W Fiber Laser with CNC XY Table.

All types of hardness testing machines are available including Brinell, Rockwell, Vickers, Durometer hardness

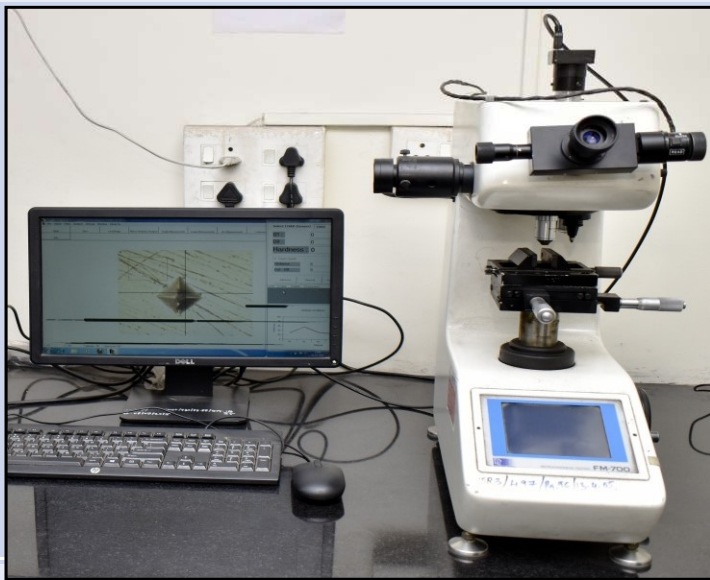
# Materials Testing and Analysis

## Universal Testing Machines (10T, 20T,60T)



- Load capacities: 10T, 20T (Servo control) and 60T
- Statistical evaluations of Results
- Load Stabilizer at any point of time for duration of maximum 1 Hr (for 20T)
- High temperature testing up to 1000 °C (for 20T) UTM
- Electronic Extensometer attachment

## Micro Hardness Tester (1 to 1000 gm)



- Micro hardness tester Future Tech FM-700, use for
- Hardness traverse
- Phase hardness
- Effective case depth measurement
- Load: 1 to 1000 gm

## Atomic Absorption Spectrometer



- AA-6300 SHIMADZU, Japan
- with wide range of lamps for analyzing elements such as Fe, Ni, Co, V, W, Mo, Hg, Cd, Li, Bi, Mn, Sb, Nb, Cu, La, Al, Si, Sn, Zn, Pb, Mg, Ca, Be, Na, K, P, In, Ga.
- Gold (Au) and Silver (Ag)
- Accuracy: 0.1 ppm

# Other Facilities

## 4 Point Probe Conductivity Meter, Lucas Lab



- Used for conductivity measurement
- Dual Configuration test method as per ASTM F84,
- standard range: 1 m $\Omega$  to 800 K  $\Omega$  per square

## Pendulum Impact Tester, IT-30, FIE



- Pendulum Impact Tester, IT-30, FIE, use for Izod and Charpy test as per BS:131-4 & BSEN:10045- 2
- Maximum Capacity Izod: 300 J
- Maximum Capacity Charpy : 168 J
- Max. Scale Graduation: 2 J

## Upcoming Facilities / Equipment

- Microwave Sintering Furnace
- Creep Testing Machine
- Laser Particle Size Analyzer
- Vacuum Induction Melting Furnace
- Glass Melting Furnace
- High Pressure Die Casting
- Cold Iso -static Pressing

# Collaborations

## Industry Collaborations

### For M.Tech. Project

- Coventya India Pvt. Ltd.
- Cummins India Ltd.
- Ador Welding Ltd.
- ARAI
- N. D. Gupta Enterprises
- JSW Steels Ltd.
- Ghordia Steels
- Jai Hind Industries,
- AVI Oilless Die Comp.P. Ltd.,

## Industry Sponsorship

- Rs. 25 Lacks in 2014 for Advanced Materials Lab. Eaton Technologies Ltd.
- Firodia School of Metallurgy and Materials Science (4Cr (in 2020)

## Academic Collaborations

- ARAI,
- ARDE
- DIAT
- C-MET
- Tridiagonal Solutions Pvt. Ltd (FactSage)

## International Collaborations

- Institute of Chemistry and Technology of Macromolecular Materials, University of Pardubice, Czech Republic.
- Department of Chemistry, Aristotle University of Thessaloniki, Greece
- Laboratory of Conducting Polymer, Institute of Macromolecule Chemistry Czech Republic.
- Department of Coating and polymeric materials North Dakota State University Fargo USA

# Contact Us

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<b>Dr. K. R. Kambale</b>	Ceramics processing, Dielectric, ferroelectric and piezoelectric materials, Solid electrolytes for batteries and fuel cells, Glasses and glass ceramics	<a href="mailto:krk.meta@coep.ac.in">krk.meta@coep.ac.in</a>
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# *75th year celebrations*

- *The department of Metallurgical Engineering was established in 1948.*
- *This Year 2022-23, the Department of Metallurgy and Materials Science, College of Engineering Pune (COEP) is celebrating its 75 years of glorious service to the Nation.*
- *Department is organizing various technical activities and alumni meet throughout the year.*

