



DHI CENTRE OF EXCELLENCE IN ADVANCED MANUFACTURING TECHNOLOGY

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

IN PARTNERSHIP WITH DEPARTMENT OF HEAVY INDUSTRIES, MINISTRY OF
HI&PE AND THE ADVANCED MANUFACTURING CONSORTIUM OF INDUSTRIES



About the Centre

The Centre is established under the support of Department of Heavy Industries of Ministry of Heavy Industries and Public Enterprises, and a consortium of Industry members. The centre drives innovative and quality research focused on industries on **Specialty materials, Design and automation, Additive manufacturing, and Digital manufacturing & Industry 4.0.**

Keeping in harmony with the Make-in-India initiative of the Government of India, this centre will house an **Innovation Lab** which facilitates the culture of innovation and open engineering. The Centre welcomes bright and talented scholars to support its

activities. It also invites MSMEs and the Start-ups to get an end-to-end support from the experts, and access to various state-of-the-art facilities for early prototyping of their product.



Goals



Promoting innovation in industrial research and commercialization



Industrial transformation through digitization



Revolutionizing MSME sector



Helping Start-ups for early prototyping



Entrepreneurial training



Securing Intellectual Property

Message from the Director, IIT Kharagpur



“ ...The Centre will aim to bridge the divide between the requirements of the leading manufacturing firms of India and the ability of SMEs to meet those requirements in globally competitive terms... ”

Message from the Deputy Director, IIT Kharagpur



“ ...Setting up of DHI CoE in Advanced Manufacturing Technology with the state-of-the-art facilities is a great step in advancing the research and technology development in manufacturing when whole world is focusing on **Industry 4.0**. The centre has been set up at the most appropriate time and I believe that the expertise that is available at IIT Kharagpur will certainly lead to a new direction with a clear paradigm shift... ”

Message from the Dean (SRIC), IIT Kharagpur



“ ... The consortium will also enable self-sustainability of the Centre beyond the period of DHI support... ”

Message from the Professor-in-Charge, DHI CoE in AMT



“ ...CoE focuses to work for solving industrial problems bringing innovation in manufacturing. It also aims to facilitate the SMEs and Startups to its state-of-the-art infrastructure for their early prototyping... ”

Ecosystem of the Centre



Ecosystem among *academia, industry, & start-up* in advanced manufacturing to develop a truly **Make-in-India** product.

Activities of the Centre

- Joint IPR protection with industry partners
- Redefine the paradigm of pre-competitive research

CREATION AND MAINTENANCE OF IPR

- Niche problems from top industry partners
- Collaborations with best in class R&D labs in the world

ADVANCED R&D IN MANUFACTURING

- Catalyze innovations and startups in modern manufacturing through STEP

INNOVATION AND START UPS

- Training workshops
- Capacity building
- Technology infusion

TRAINING FOR SMEs

Partnership Model

**CORE-
45 Lakhs/year**

with a commitment of
5 years

**ASSOCIATE-
15 Lakhs/year**

with a commitment of 5 years

**AFFILIATE-
5 Lakhs/year**

with a commitment of
5 years

Partners of CoE

International Research Adviser



Consortium Partners



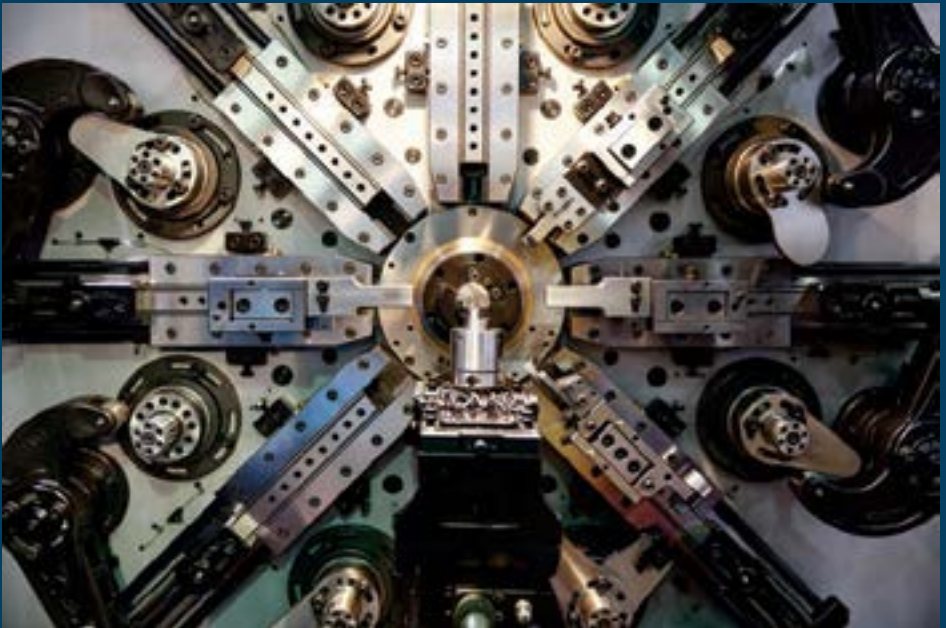
Heavy Engineering Corporation Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
Ranchi, India



Research Paradigms

Specialty Materials

The centre aims to become a global leader in niche materials and their processing. Looking at the manufacturing sector, the intention is to cover corrosion-resistant, wear-resistant, light-weight metallic materials, composites, electronic materials, biomaterials, glass and ceramics. The CoE along with the consortium of industries will work together on development of such materials for different applications in the capital goods sector.





Design, Fabrication and Automation of Manufacturing

The centre aims to address the infusion of modern technologies in the design and manufacturing of components, its fabrication and automation. The centre aims to bring about transformational changes in the design of machines and industrial processes in some areas.





Additive Manufacturing

Additive manufacturing has huge potential to completely transform the landscape of manufacturing in some areas. Today manufacturers from diverse domains are exploring 3-D printing as a technology for complementing their existing and conventional processes for prototyping and manufacturing. Research under this thrust area will be carried out for prototyping different forging components of automobile, steel sector, turbine blades etc.





Digital Manufacturing and Industrial IoT

IIoT and data analytics are expected to have pivotal role in enabling the vision of smart machines and intelligent cooperation between multiple machines. Research under this category will cover different types of robots for hazardous jobs. This will boost up the various sub-sectors of Indian Capital Goods sector including metallurgical equipment and mining machinery such as earth mover, remote operating machinery, underground mining equipment & attachments etc.





Innovation lab

The Innovation Lab under the centre will facilitate the culture of innovation and open engineering. It invites MSMEs and the Start-ups to grab opportunities of getting an end-to-end support from the experts including access to various state-of-the-art facilities for early prototyping of their product.



Infrastructure @ Innovation Lab

5-Axis CNC Wire-cut EDM



- Submerge type 5-axis CNC controller with TURBO motion control technology.
- Machining of Poly – Crystalline Diamond
- Auto wire threading facility available.
- Multistage water filtration facility available.

Make: Electronica

Model: Enova 2S

UTM



- State-of-the-art 50 kN tensile-compression-fatigue-creep testing unit along with non-contact video extensometer.
- Specimen tensile testing at 1200 oC.
- Low cycle creep fatigue tests under strain

Make: Zwick Roell

Model: Kappa 100 SS-CF

CT Scan System



- 450 kV CT system with large scanning area.
- Dual detectors for bigger objects and instant 2D and 3D imaging systems.
- Software for CT acquisition, reconstruction, metrological analysis, co-ordinate measurement, wall thickness measurement, CAD data comparison, porosity/inclusion/crack analysis etc.

Make: GE Sensing & Inspection Technologies

Model: Phoenix V/tome/x c

Hybrid Additive Manufacturing



- 5-axes CNC machine tool with subtractive machining & direct laser deposition based additive system.
- Capability of building mid to large 3D parts by using metal powders in controlled atmosphere.
- Equipped with an Ytterbium Fiber laser of 2 kW.
- MasterCAM Mill 3D professional software

Make: Optomec

Model: LENS 860 Hybrid Machine

CNC Machining Centre



- Industry 4.0 enabled with accuracy up to $< 6 \mu\text{m}$
- Optimized ergonomics and design
- Larger machining compartment
- Improved cooling in all drives and guides
- Direct path measuring system in all five axes

Make: DMG Mori

Model: DMU 50

5 MP Blue Light Scanner



- Blue LED technology scans many surface types
- 5 million points per scan
- 5 interchangeable lenses
- Up to $18 \mu\text{m}$ point spacing
- Fast scanning, high accuracy and portable
- Rotary table for automatic scanning

Make: Zeiss

Model: Zeiss Comet 5M

Robotic 3D Laser Scanning Structural Vibration Test Station



- Frequency range: 0-100 kHz.
 - 3D laser scanning vibrometers mounted on a multi-axis industrial robot, payload= 90 Kg & controlled axes= 6 + 1 (linear track of 4 m length).
 - Software for incorporating FE geometry, external sensor data, & modal analysis.
 - Software for analyzing signals in time domain and principal component analysis.
-

Make: Polytec

Model: PSV-500-3DH

Sample Cutting Machine



- Automatic cut-off machine with intelligent feed control.
- Variable spindle speed and automatic feed.
- Automatic cleaning facility
- Can cut very hard materials.

Make: Struers

Model: Discotom

Hot Mounting Press



- Electro-hydraulic hot mounting press.
- Fast heating available.
- Automatic detection of cylinder dimension.
- Automatic dosing system for faster filling.

Make: Struers

Model: CitoPress 15

Grinding & Polishing Machine



- Semi-automatic grinding and polishing machine with stable sample preparation facility.
- Automatic water ON/OFF system.
- Easy drying and cleaning facility.

Make: Struers

Model: LaboPal 30

Electrochemical Station



Make: Gamry

Model: 1010E

- The system can be utilized for electrochemical corrosion, battery testing, fuel cell testing, and physical electrochemistry.
- Other studies such as critical pitting temperature, electrochemical noise, direct current corrosion etc.
- A wide range of current ranging from 10 nA to 1 A with a minimum current resolution of 3.3. fA.

Stereozoom Microscope



- Apochromatically corrected optics
- Touch screen controls for magnification and resolution, depth of field and object field.

Make: Carl Zeiss
Model: Discovery V20

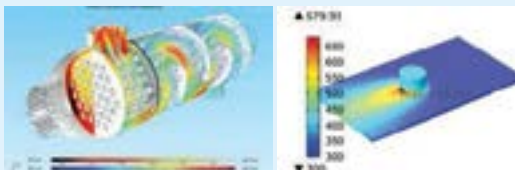
Metallurgical Microscope



- Intelligent automation
- Imaging contrast technique
- Ultra-contrast 3D illumination
- Sample re-position capacity up to 20 nm.

Make: Leica Microsystems
Model: DMi8A

COMSOL Multiphysics Modeling Software



Make: COMSOL
Model: COMSOL Multiphysics

- A general purpose **simulation software** for **modeling designs, devices, and processes** in all fields of **engineering, manufacturing, and scientific research.**
- Comes with an “**Application Builder**” which can be used to develop independent domain-specific applications with customized user-interface.

Few more software to be purchased:

- 3D EXPERIENCE
- SOLIDWORKS
- AUTOCAD
- INVENTOR

Other Infrastructure Available @ CoE

High Resolution FESEM



- Schottky emitter for high-resolution.
- Unique wide field optics.
- Real-time in-flight beam tracing.
- 5-axis fully motorized compucentric stage.

Make: TESCAN

Model: TESCAN MIRA 3 LMH

Table-top XRD



- 6th gen. design with factory aligned goniometer system
- Compact, fail-safe radiation enclosure.
- Incident beam variable slit
- Phase identification, quantification with crystallinity percentage, crystallite size and strain etc.

Make: Rigaku

Model: MiniFlex

Robot-assisted Micro Friction Stir Welding Machine



- Industry 4.0 enabled FSW machine assisted by a 500 Kg payload robot with a reach of 2830 mm.
- Suitable for micro-size jobs & dissimilar materials.
- 6D force sensor for monitoring forces and torque in all three directions.

Make: KUKA

Model: KR 500 R2830 MT

CNC Turning Centre



- 3-point leveling and cast iron monoblock structure
- High precise in positioning and repeatability
- Electric spindle with high torque
- High spindle rotational speed

Make: ACE Designers Limited

Model: LT 20 XL

Computer Integrated Manufacturing Facility



- CNC Milling and CNC Turning units.
- Inspection / quality control – vision control system.
- Vibration, temperature and proximity for sensing manufacturing data.
- Data storage, retrieval, manipulation and presentation by using IoT gateway.

Make: MTAB

List of various sensors being purchased:

- Thermal imager
- Wide range thermal imager
- Power sensor
- Vibration sensor
- Speed sensors
- Various types of thermocouples
- Oil quality monitoring sensors:
 - Flow rate
 - Pressure
 - Liquid level
 - Turbidity
- High speed camera
- Piezoelectric force transducer



Other Facilities Being Created @ CoE

- Linear Torsional Fatigue Testing Centre
- Industrial Robot with Offline Simulation Software
- Ultrasonic Range Sensors
- Image Processing Workstations
- High end Computers & Servers for Research on Industry 4.0
- IoT Hardware Infrastructure
- Software such as:
- 3D Modelling
- Reverse Engineering
- Rapid Prototyping Preprocessor
- Life Cycle Analysis
- Shot Peening Machine
- Jet Cleaning System & Ultrasonic Bath
- Acoustic Array

Faculty Members Associated to Projects of CoE



Chakrabarti Debalay

Research Areas:

- Microstructure property correlation study
- Study on texture in thermo-mechanical process



Deb Sankha

Research Areas:

- Computer Integrated Manufacturing
- Automation and Robotics



Kar Sujoy Kumar

Research Areas:

- Processing-Structure-Texture-Property
- Neural network & Thermokinetic modelling



Kumar Cheruvu Siva

Research Areas:

- Robotics & Computer-Aided Engineering (CAE)
- Additive and Laser based Manufacturing



Kumar Akhilesh

Research Areas:

- Business Analytics
- Closed-loop Supply Chains



Kumar Sri Krishna

Research Areas:

- Supply Chain and Logistics
- Operations Research (OR)



Mahanty Biswajit

Research Areas:

- Operations management
- Systems Dynamics & Simulation



Misra Sudip

Research Areas:

- Sensor Networks
- Internet of Things (IoT)



Nath Ashish Kumar

Research Areas:

- Laser material interaction and processing
- Underwater laser processing

Faculty Members Associated to Projects of CoE



Pal Surjya Kanta

Professor in Charge, CoE

Research Areas:

- Friction stir welding
- Industrial IoT
- Manufacturing process modelling



Sarmah Sarada Prasad

Research Areas:

- Supply Chain Management and Logistics
- Reverse Logistics



Tiwari Manoj Kumar

Research Areas:

- Manufacturing Operations Planning
- Supply Chain Management and Logistics



Roy Gour Gopal

Research Areas:

- Computational Fluid Dynamics
- Electron beam welding



Sen Debashis

Research Areas:

- Image and Video Processing
- Vision



Saha Partha

Research Areas:

- Non-conventional manufacturing
- Rapid prototyping



Singh Shiv Brat

Research Areas:

- Physical Metallurgy of steels
- Phase Transformations

Media

Business Standard

Centre of Excellence on advanced manufacturing technology launched at IIT Kgp

13/10/2017, Kharagpur, November 08, 2017 (Last Updated on 20/10/2017)

The Union Heavy Industries and Public Investment Industries Department of Heavy Industries in West Bengal launched the Centre of Excellence on Advanced Manufacturing Technology at IIT Kharagpur, with a 100% funding of Rs. 50 crore.

The centre for advanced manufacturing technology at IIT Kgp, which is expected to be fully functional by the end of the financial year 2018 of the Public Works, is a 100% state-funded project by the department, which signed a MoU with IIT Kharagpur in the presence of the Union Minister of Heavy Industries and Public Investment Industries in West Bengal.

The centre will focus on the latest manufacturing technologies and support the industrial sector to enhance the depth in manufacturing through innovation and technology upgradation, free importation, specially designed, process automation, additive manufacturing, intelligent automation and intelligent industry 4.0.

"The Centre will aim to bridge the divide between the requirements of the leading manufacturing firms of India and the ability of Indian firms to meet these requirements globally competitive," said P. Chakrabarti, Director, IIT Kharagpur.

It is being jointly supported by a consortium of leading industrial houses.

"It is unique for the leading industrial houses in India to come together to invest in innovation and jointly support the emerging Centre on Advanced Manufacturing Technology. We share the conviction about the industrial partnership because the need for adoption of new-age technology in the manufacturing sector demands holistic, integrated and multi-dimensional perspective of all stakeholders in this regard."

"The consortium will also enable self-sustainability of the Centre beyond the period of 2017 support" and Public Investment Industries, Union Minister, IIT Kharagpur.

The consortium leading industrial houses including Tata Steel, Tata Motors, Tata Steel ICL, Rastar India, Progress, Bharat Engineering Corporation, Bharat Heavy Electrical Limited and Ranpara Vehicles.

The facility will have state-of-the-art physical infrastructure for additive manufacturing like 3D printing, advanced casting, finishing, safety and more. Process like welding, forging and manufacturing equipment systems such as 7-axis industrial robot, multi-axis machine for turning, machine analysis and research.

IIT self-help for facility

By Nagesh K. Srinivasan

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millenniumpost

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IIT Kharagpur sets up centre of excellence

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Industrial Research & Innovation Unit

A 40000 Sq-ft state-of-the-art Industrial Shed is coming up to house the equipment



INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
Kharagpur, West Bengal 721302

Contact us

Prof. Suriya Kanta Pal
Professor In-Charge
DHI Centre of Excellence in
Advanced Manufacturing Technology
5th Floor, CRR building
Email: coeamt@iitkgp.ac.in
website: www.coeamt.com
Ph: +91-3222-281984