Improved Manufacturing & Industrial Management is the new paradigm towards India's growth and innovation

Production & Industrial Engineering

01 **Manufacturing Technology**

02 **Engineering Management**

03 **Engineering Sciences (Mechanical, Metallurgical, Electrical/Electronics, Computer, Chemical etc.)**

04 **Sustainability**

Manufacturing is the Key Engine for a Country's Economic Growth

VOCAL FOR LOCAL

MAKE IN INDIA

AATMA-NIRBHAR
BHARAT

Lab Equip
Research
The Team
Projects
History
Mission & Vision

WELCOME

DEPARTMENT OF PRODUCTION &INDUSTRIAL ENGINEERING

Birla Institute of Technology, Mesra, Ranchi

Departmental Vision

To become a centre of repute striving continuously towards providing quality education, research and innovation in the Field of Production and Industrial Engineering

Departmental Mission

- To provide quality education at both undergraduate and post graduate levels.
- To provide opportunities and facilities for research and innovation in Production and Industrial Engineering.
- To produce industry-ready graduates to meet the demands of manufacturing industries, knowledge-based software firms, supply chain and logistic firms, and R&D organizations
- To integrate skills on state-of-the-art manufacturing technology with industrial engineering and operations management
- To impart latest knowledge in the domain area to students by continuous up-gradation of curricula and faculty

Lab Equip

Research

The Team

Projects

1964
1
BE
Production Engineering

1992
2
ME
Automated Manufacturing Systems

2018
3
BTECH/MTECH
CBCS

2021
4
BTECH
Production & Industrial Engineering

History

Mission & Vision

Lab Equip
Research
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2001
FIST 1
49 lakhs

2006
AICTE NCP
20 lakhs

2007
UGC SAP
32 lakhs

2008
DST FIST II
110 lakhs

Major Projects
History
Mission & Vision

Name of the funding agency	Project Title	Year of Funding	Duration In Years	Amount (lakhs)	Status:
AICTE	Development of CAM Lab	1995-96	02	12	C
AICTE	Process Automation in Steel Industry	1996-97	02	05	C
UGC	Agile Manufacturing Technology	1997-98	02	4.12+PA	C
AICTE	Effect of Ergonomic Status of Industrial works in Tribal area of Production	1998-99	02	10	C
UGC	Design and allocation of work under extreme environmental conditions	1998-99	03	6.5	C

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Name of the funding agency	Project Title	Year of Funding	Duration In Years	Amount (lakhs)	Status:
DST	Formability of Sintered Preforms	1998-99	02	18.3	C
AICTE	Water Jet Technology Lab	1998-99	03	10	C
AICTE	Modernization of laboratory	1998-99	02	08	C
AICTE	Development of Manufacturing System Design Lab	1999-00	02	05	C
DST (FIST-I)	Centre for Advanced Material Processing	2001	05	49	C

Projects
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Name of the funding agency	Project Title	Year of Funding	Duration In Years	Amount (lakhs)	Status:
AICTE	Development of manufacturing Mechatronics Laboratory	2001	02	12	C
UGC	Electro Chemical Machining	2002	02	05	C
AICTE (NCP)	Deformation and Fracturing Behaviour of Metallic Foams	2006	03	20	C
UGC (SAP)	Creating infrastructural facilities for training and research in precision forming.	2007	05	32	C

Name	Project Title	Year of Funding	Duration In Years	Amount (lakhs)	Status:
DST (FIST-II)	Centre for Advanced Material Processing	2008	05	110	**C**
MSME	Enhancing productivity and competitiveness of rural brassware manufacturing units of Jharkhand state through cluster development.	2008	03	3.5	C
UGC	Microwave Assisted Welding	2013	03	5.55	**C**

Name	Project Title	Year of Funding	Duration In Years	Amount (lakhs)	Status:
1	Time and Motion study for payment of waged to workers in the Jharkhand state under National Rural Employment Guarantee Act 2005(NREGA). The model developed is being used for fixing wages under MNREGA	2005	1	10.00	c

Current Projects

Sl. No.	Project title	PI/CoPI	Funding Agency	Sanctioned amount	Funding Scheme	Date of Sanction	Duration	Status
1.	Manufacturing and characterization of aluminium alloy hybrid nanocomposite produced by stir-ultrasonic-squeeze casting method for automotive application	PI: Dr. Joyjeet Ghose Co PI: Dr. Bappa Acharjee	DST SERB	40Lac	CRG	Jan 2022	3 years	Approved

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Production & Industrial Engineering, BIT Mesra

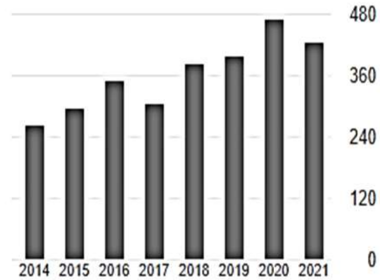
FOLLOW

Birla Institute of Technology
Verified email at bitmesra.ac.in - Homepage
Production and Industrial E...

TITLE	CITED BY	YEAR
Implementing the Lean Sigma framework in an Indian SME: a case study M Kumar, J Antony, RK Singh, MK Tiwari, D Perry Production Planning and Control 17 (4), 407-423	542	2006
Implementing lean manufacturing with cellular layout: a case study LN Pattanaik, BP Sharma The International Journal of Advanced Manufacturing Technology 42 (7), 772-779	171	2009
Prediction of weld strength and seam width for laser transmission welding of thermoplastic using response surface methodology B Acherjee, D Misra, D Bose, K Venkadeshwaran Optics & Laser Technology 41 (8), 956-967	140	2009

Cited by VIEW ALL

	All	Since 2016
Citations	3752	2327
h-index	32	26
i10-index	76	52



Co-authors EDIT

Publications
History
Mission & Vision

Textbook 1

Tool Design, SIE, 5th Edition, Cyril Donaldson, George H. LeCain, V. C. Goold, Joyjeet Ghose, McGraw-Hill Education, 2017, ISBN 9789352605798

Textbook 2

Manufacturing Processes for Engineering Materials, Sixth Edition, SI Edition, Serope Kalpakjian, Steven R. Schmid, SI Edition Contributions By Joyjeet Ghose, Pearson, 2018, ISBN 978-93-530-6291-0

Book chapter, 1

Potentiality of Luffa Fiber Used as Reinforcement in Polymer Composites, Sudhir Kumar Saw, Joyjeet Ghose and Gautam Sarkhel, M. Jawaid et al. (eds.), Green Bio composites, Green Energy and Technology, Springer International Publishing AG 2017,

Book chapter, 2

Neural Network Based Breakout Predicting System for All Four Strands of Caster in a Continuous Casting Shop—A Case Study, Md Obaidullah Ansari, J. Ghose and R. Kumar, pp 89-100, Sudip Kumar Sahana · Sujan Kumar Saha (eds.),

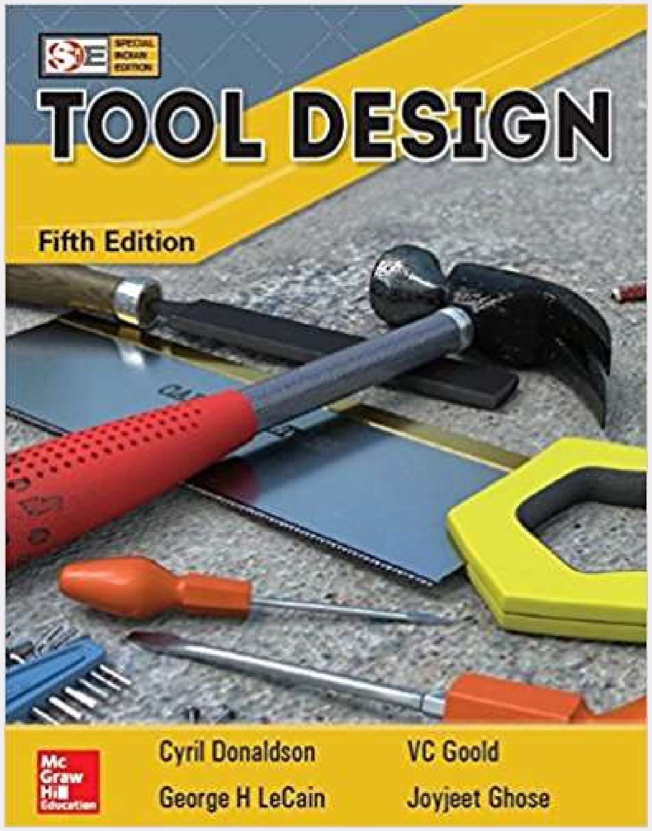
Book chapter, 3

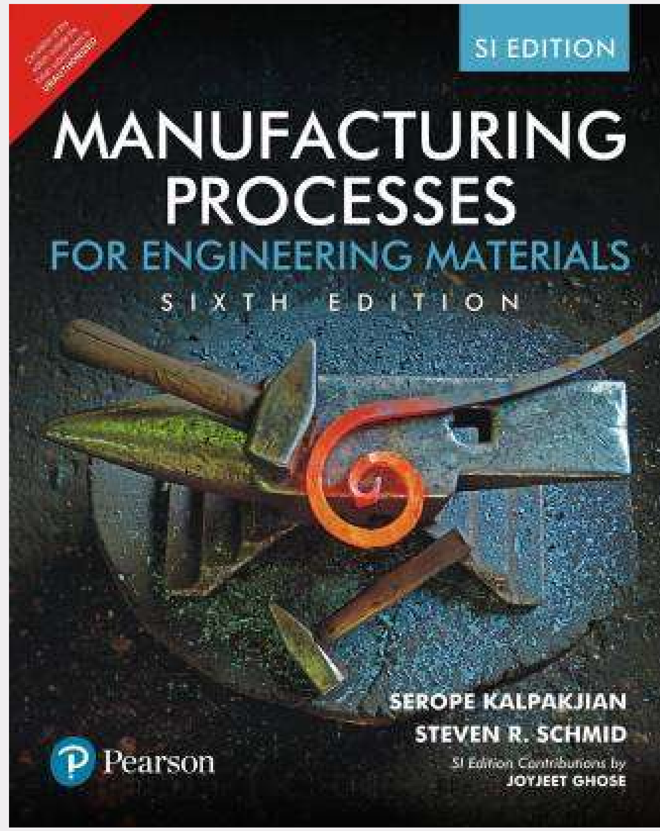
Thixoforming of Light-weight Alloys and Composites: An approach towards Sustainable Manufacturing, S Deepak Kumar, J Ghose, Sustainable Engineering Products and Manufacturing Technologies, Editors: Kaushik Kumar Divya Zindani Paulo Davim, Elsevier, 1st June 2019,

Book chapter, 4

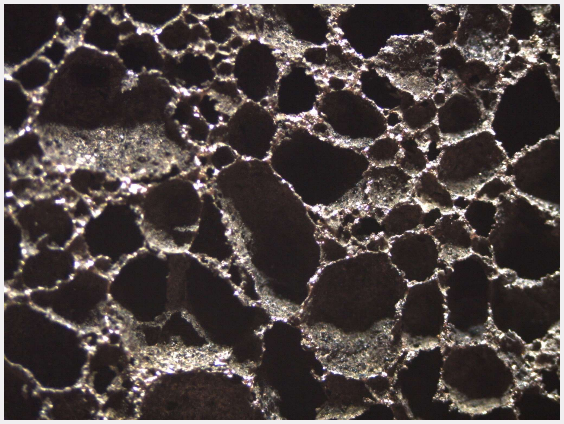
Optimization and Simulation of Additive Manufacturing Processes: Challenges and Opportunities– A Review, Additive Manufacturing Applications for Metals and Composites, Eds: K.R. Balasubramanian (National Institute of Technology, Tiruchirappalli, India) and V. Senthil kumar (National Institute of Technology, Trichy, India), Release Date: June, 2020, |Pages: 348

Lab Equip
Research
The Team





Books
History
Mission & Vision



Aluminium Metal Foam

Setup

2020

Indian Patent

Name of the Patent: **Aluminium Metal Foam and a process for Preparation thereof**

Patent grant date 09.06.2020.

Patent No Indian Patent vide no. 338236

Inventor: Joyjeet Ghose, Vinay Sharma & Surender Kumar

01

Kripashankar Singh

ADJUNCT PROFESSOR

Industrial Engineering

02

Vinay Sharma

PROFESSOR

Manufacturing technology, Industrial Engineering

03

S K JHA

COE, ASSOCIATE PROFESSOR

Manufacturing technology, Industrial Engineering

04

RITESH K SINGH

ADOFA, ASSOCIATE PROFESSOR

Industrial Engineering

05

L N PATTANAIK

ADPGS, ASSOCIATE PROFESSOR

Logistics and Supply Chains Lean, RMS Soft Computation, Data Analytics Modelling and Simulation

Lab Equip
Research

06

JOYJEET GHOSE

HOD, ASSOCIATE PROFESSOR

Manufacturing, Metal Composites

07

BAPPA ACHARJEE

ASSISTANT PROFESSOR

Advanced Manufacturing
Welding and μ-Machining
Modeling and Simulation
Decision Engineering

08

SOMAK DATTA

ASSISTANT PROFESSOR

Manufacturing Technology
Artificial Intelligence
Industrial Engineering

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09

BINAY KUMAR

ASSISTANT PROFESSOR

Product Design and Development Quality Control and Assurance Manufacturing Technology Work study and Ergonomics

10

ABHISHEK K SINGH

ASSISTANT PROFESSOR

Sustainable Manufacturing, Circular Economy, Automated Manufacturing System

11

SANJIV K TIWARI

ASSISTANT PROFESSOR

Quality Engineering, Industrial Engineering, Manufacturing Engineering

12

RANDHIR KUMAR

ASSISTANT PROFESSOR

SEMI SOLID FORGING, MANUFACTURING PROCESS, SEMI SOLID PROCESSING

13

Gayatri Paul

ASSISTANT PROFESSOR

Nannofluids, Ferrofluids, Nanolubricants, Tribology, Boiling, Rewetting Phenomenon, Materials Characterization, Nanoparticle synthesis

14

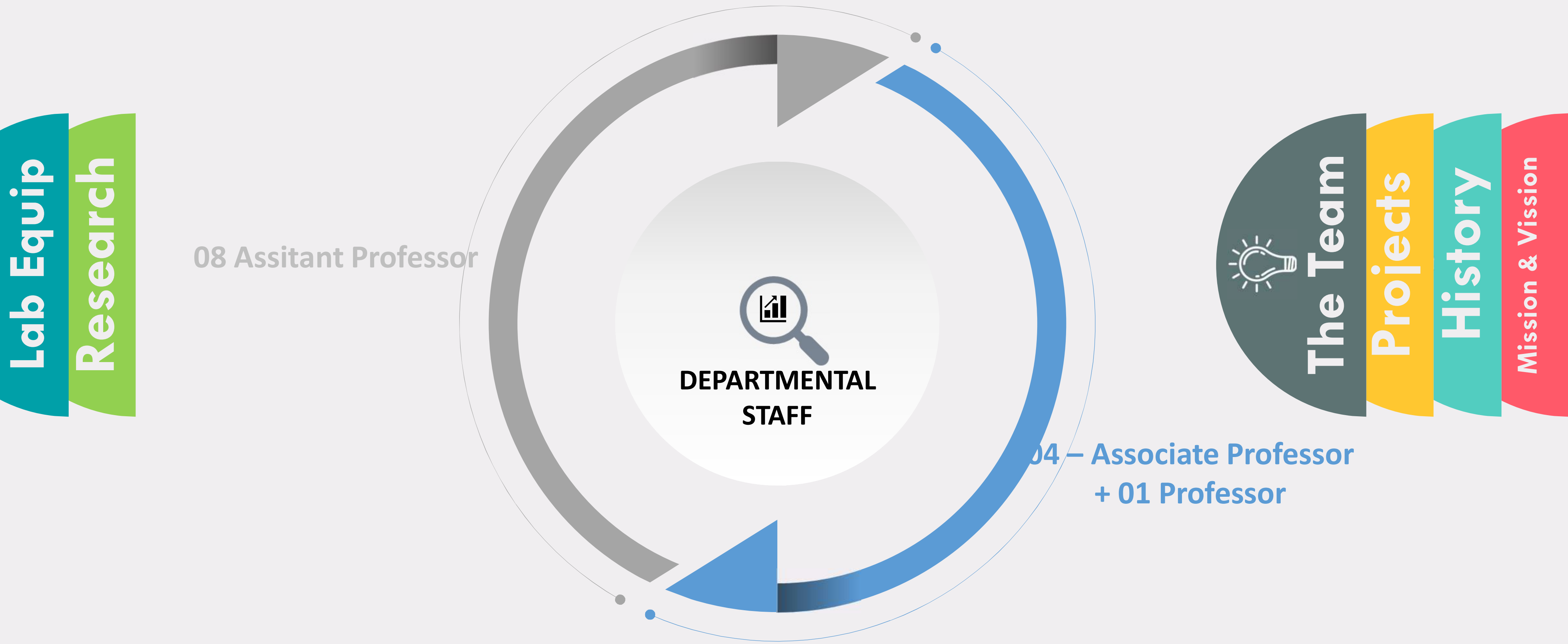
Suman Samanta

ASSISTANT PROFESSOR

Industrial Engineering

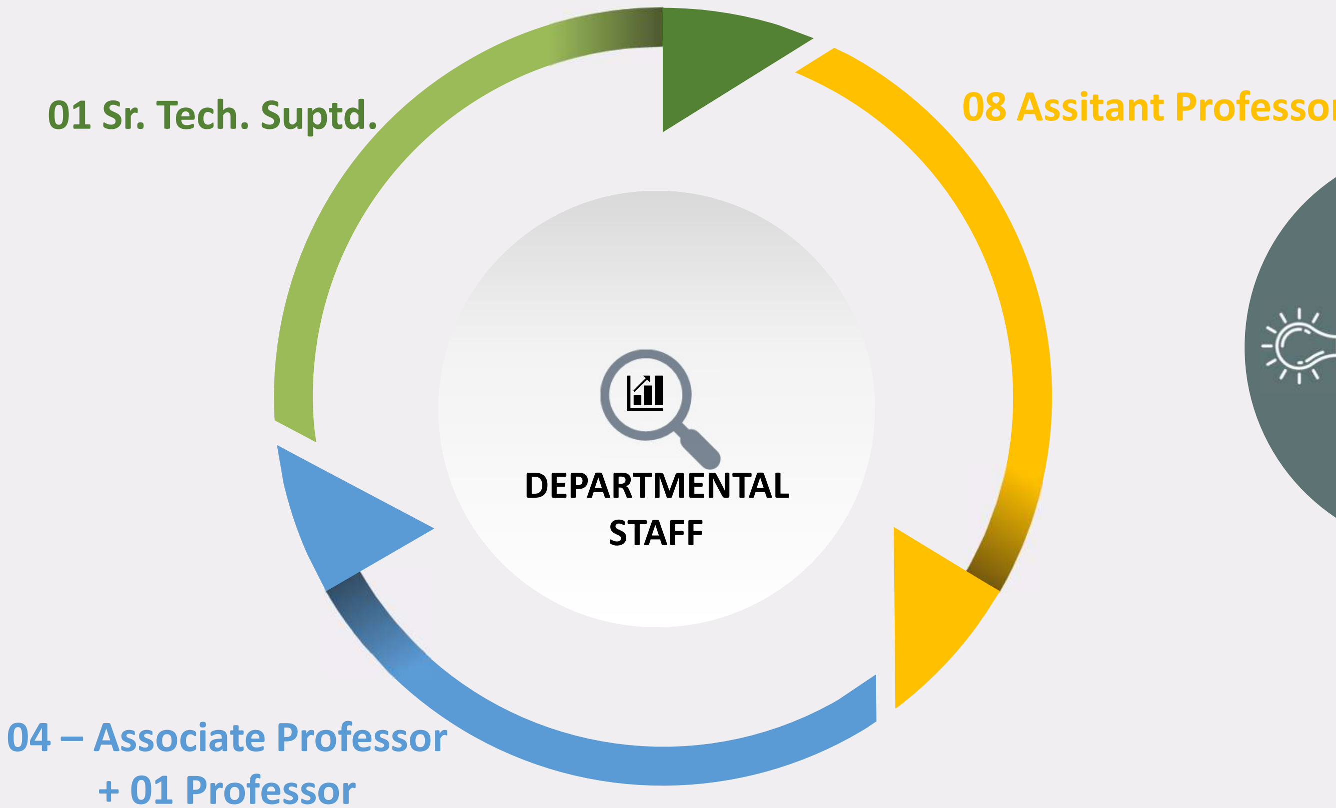
Department of Production & Industrial Engineering

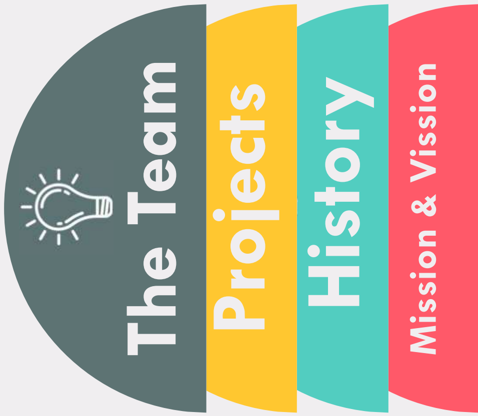
- **Cadre distribution**



Department of Production & Industrial Engineering

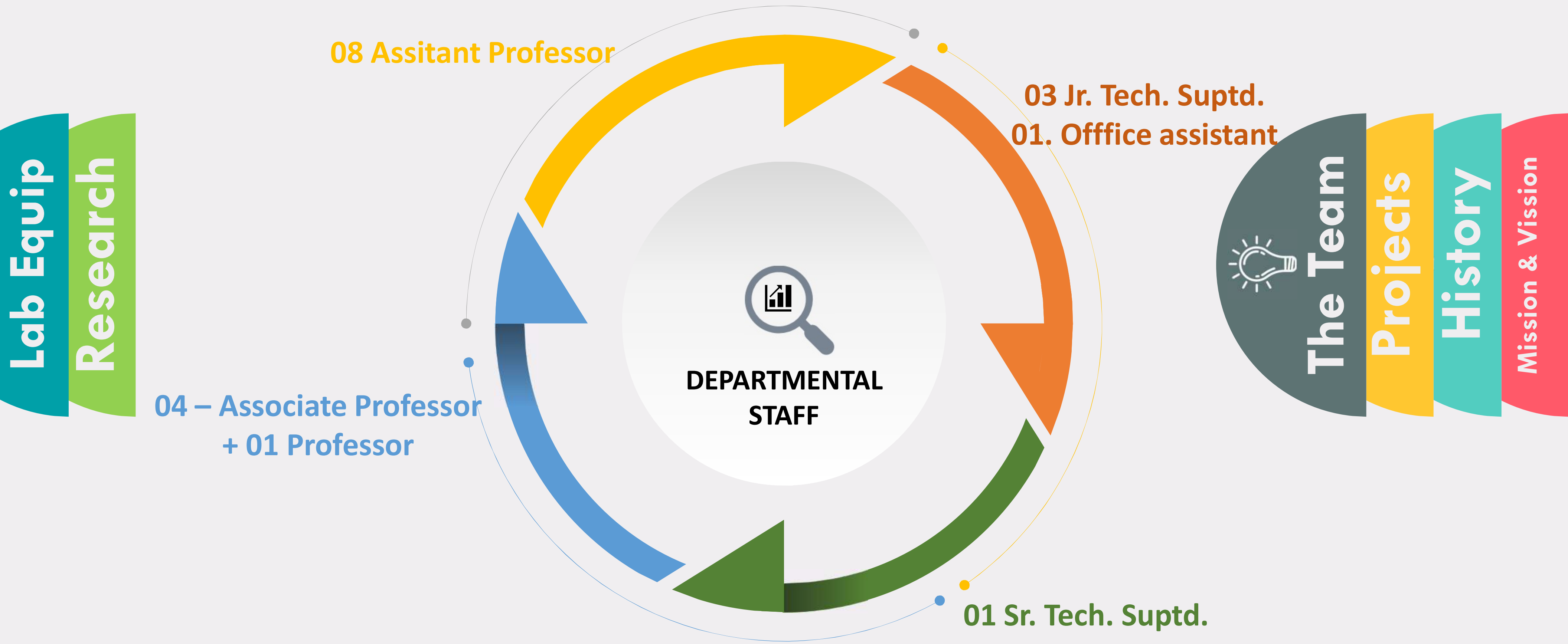
- Cadre distribution





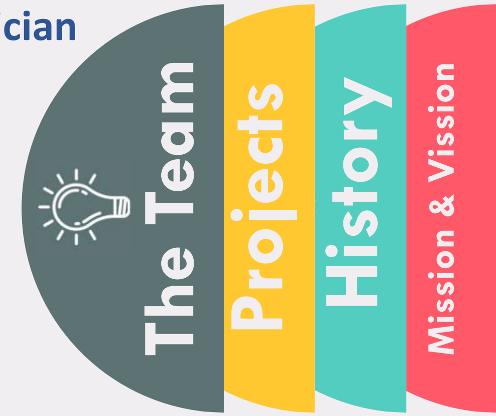
Department of Production & Industrial Engineering

- Cadre distribution



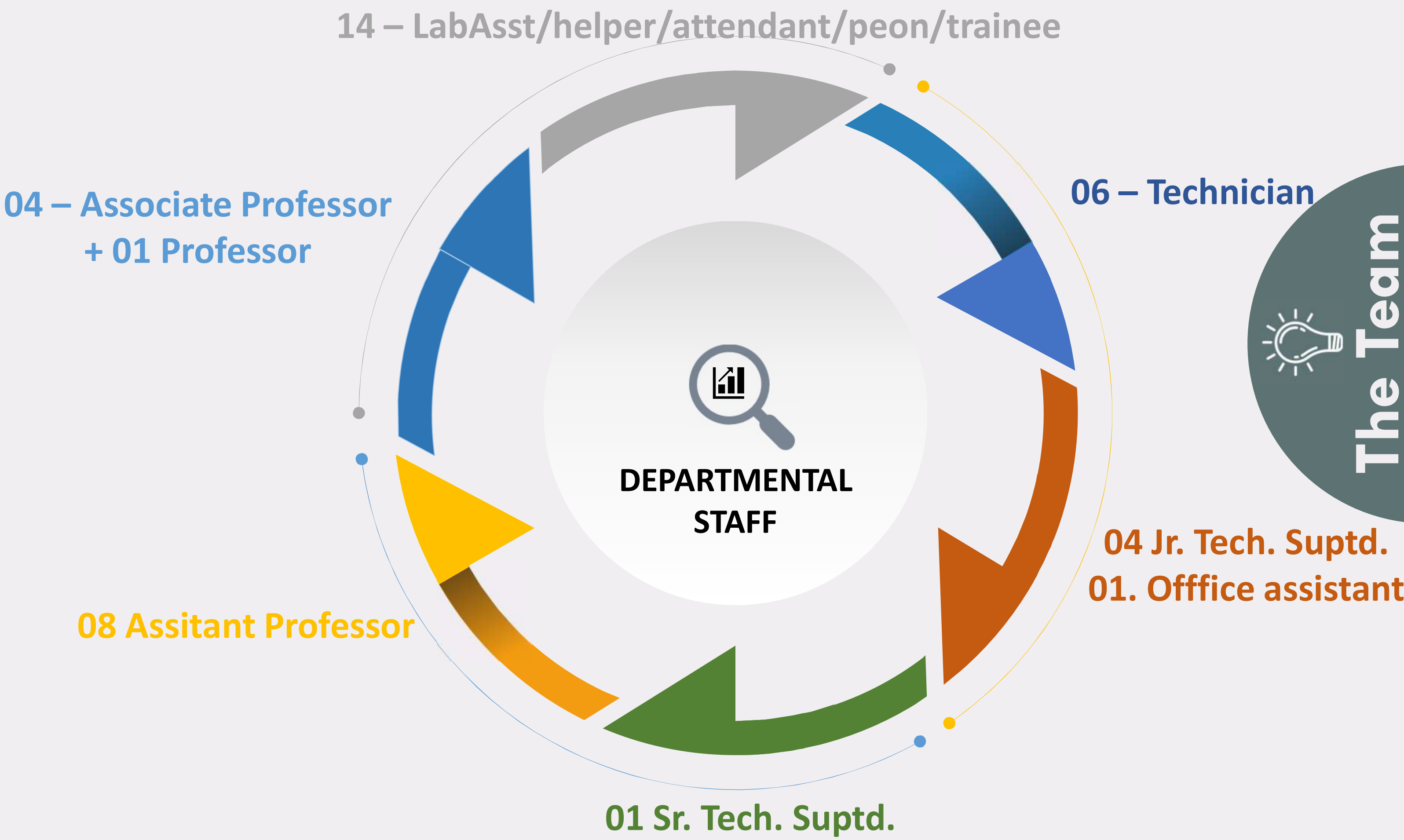
Department of Production & Industrial Engineering

- Cadre distribution



Department of Production & Industrial Engineering

- **Cadre distribution; Total: Faculty 10, staff 26**



Lab Equip
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Lab Equip

Metal Casting

Stir Casting, Ultrasonic casting, squeeze casting, metal foam, MMC composites

Welding

Submerged Arc Welding ATIG Welding, Laser welding, Friction stir welding

Supply Chain Management

Plan, Source, Make, Deliver and Return. logistics

Quality control

Lean-Six Sigma etc.

Micro-Machining

Micro-drilling, micro-turning, micro milling, Micro EDM, WEGD etc.

Sustainable Manufacturing

Green Manufacturing, Energy Audit, LCA, Circular Economy etc.

Manufacturing Technology Related Research

- Production of Metallic Foam
- Microwave-assisted manufacturing processes
- Incremental sheet metal forming
- Production of Aluminium Nano Metal Matrix Composite
- Micromachining of metals, ceramics, polymers, and composites, and analysis of machining quality, performance, and process efficiency.
- Welding of metals, polymers and hybrid structures and analysis of weld efficiency, weldability, mechanical performance of the weld.
- Semi-Solid Metal Processing
- Additive Manufacturing
- Surface Engineering
- Fabrication of composite material through powder metallurgical routes

Lab Equip
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Industrial Engineering

1. Sustainable supply chain for perishable materials
2. Lean manufacturing and fuzzy theory applications to reverse engineering
3. Value Stream Mapping
4. Modular Product Development
5. Industry 4.0
6. Optimization

Lab Equip
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Wire EDM

Wire EDM and
Micro
Machining

CNC Plasma

For Cutting thick
sheets of steel

CNC Lathe

For Turning

Lab Equip
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Simulation Lab

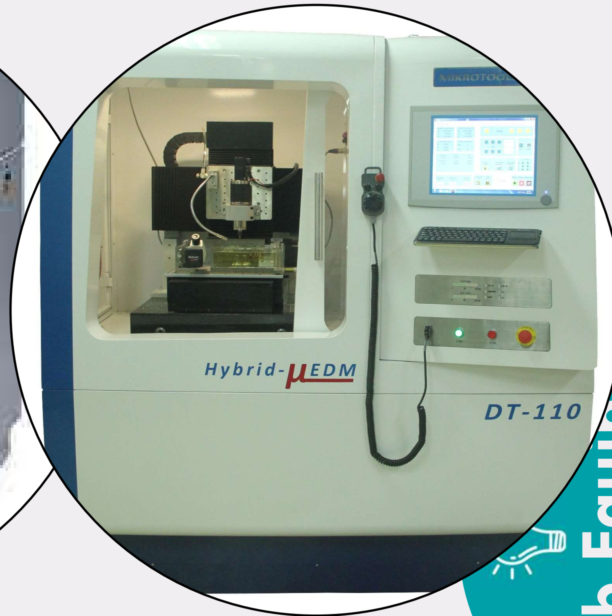
Computation facilities, Witness, Minitab, Catia, NX CAM

Conventional Automation

Single Spindle lathe, Gear hobber, Cylindrical Grinding etc.

M/C Shop

Various Machine tools



Stir Casting Furnace

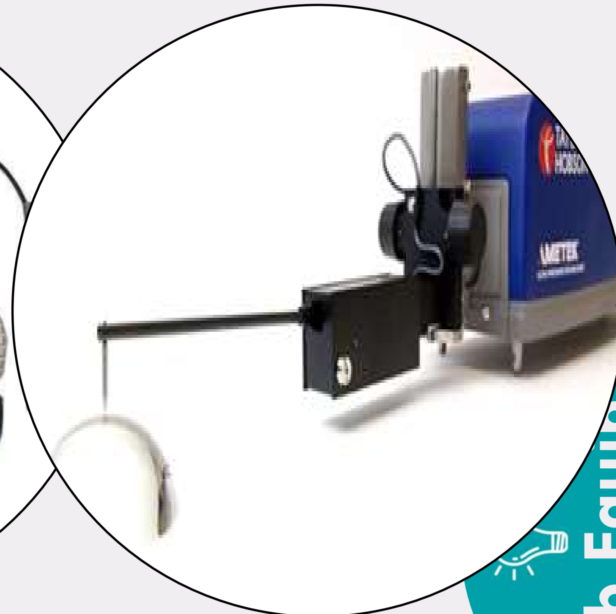
For making MMC Composites

Erichsen Cupping Test

For Formability test

DT110

Hybrid Micro Machining Machine



Zeiss Microscope

For metallographic studies

Ultrasonic Flaw detector

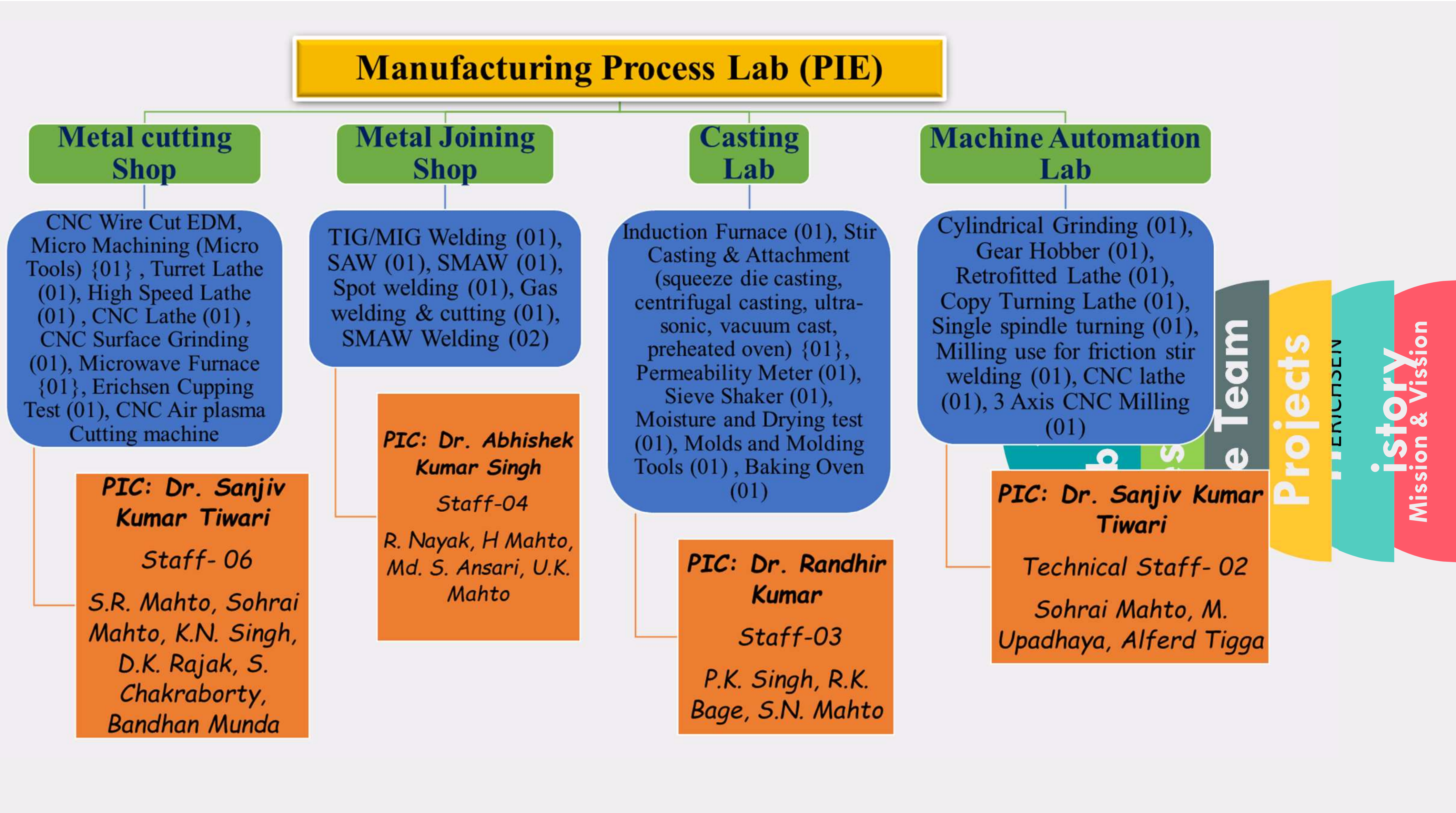
For check defects in weldments and casting

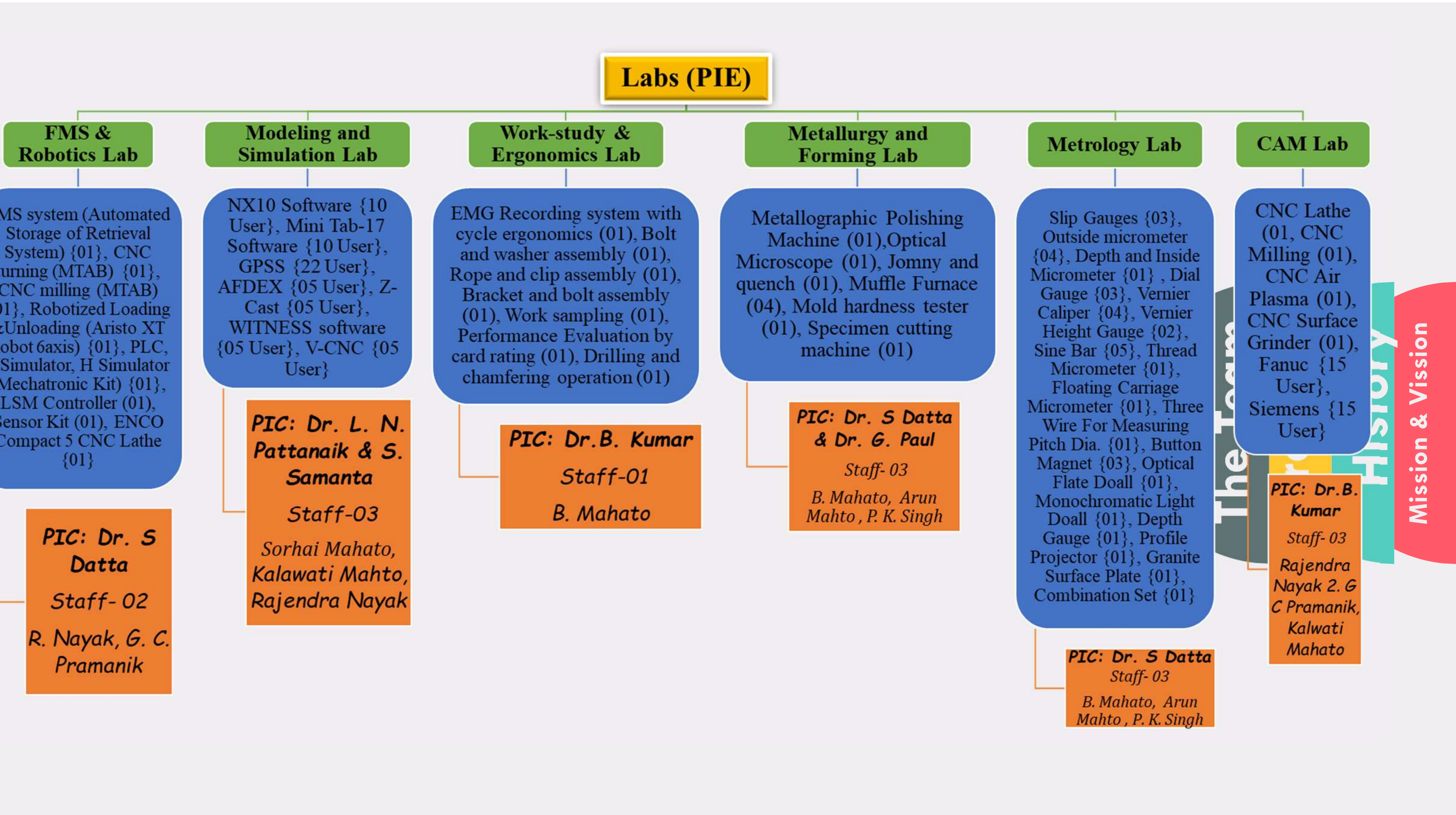
TAYLOR HOBSON Contour tracer

For measuring the contour of any product

le	Generic Name of Equipment	Cost, Model, Make & year of purchase	Remarks including accessories available and current usage of equipment	Current Status (working/not working). If not working, then intimate the action taken at your end.
	MICRO MACHINING MACHINE TOOL	Model- Micro Tools DT-110 MICRO TOOLS PTE LTD Cost- 180,000 Singapore Dollar Year of purchase- 12.12.11	Integrated Multi-Process Micro-Machining Machine Tool 1. Micro Turning 2. Micro Milling 3. Micro WEDM 4. Micro WEDG 5. Micro EDM	Working
	Elektra CNC Wire Cut EDM	Model- Electronica M/C Tools Pvt. Ltd. (MAXICUT-734) Cost- 20,00,000/- Year of purchase- 2012	Preparing for workpiece for any conductive material	Working
	Cupping Test Machine	ERICHSEN Cost- 48084 (EUR) Year of purchase- 2017	Formability Study of any material	Working
a K.	Microwave Heating Furnace	Hybrid Microwave Furnace Cost- 4,20000/- Year of purchase- 2014	Combination of conventional and Microwave heating with working temperature up to RT to 1600°C	Working
	Ultrasonic Flow Detector	Model- Swift Scan-360 Ultrasonic Flaw Detector Cost- 4,08,450 Year of purchase- 2019	Flaw detector together with high accurate thickness measured, Auto Calibration: Velocity, Probe Delay, Angle.	Working

	TIG/MIG Welding	**Model- EWAC alloys Ltd. Trans synergic 500 comfort** **Cost- 3,70,938** **Year of purchase- 2007**	**Welding**	**Working**
	Stir Casting & Attachment (squeeze casting, centrifugal casting, ultrasonic, vacuum cast, preheater oven)	Model- SWAIM Equipment Cost- 11,22,123 (equipment)+ 10,30,000/- (Attachments) Year of purchase- Equipment 26.02.2016 Attachment: 21.09.2016	Casting	Working
CP	Electric Resistance Furnace	Model- M.G. Electrical Cost- Year of purchase- 2006	Heat treatment process	Working
	Optical Microscope	Model- Carl Zeiss Microscope AXIO Cost- 25739 (EUR) Year of purchase- 2017	Generate magnified images of small objects, average grain size is calculated.	Working
	Contour Tracer	Model- TAYLOR HOBSON Cost- 21075(GBP) Year of purchase- 2018	Simple analysis functions such as basic dimensioning, distance measurement to more complex functions like full contour analysis and Gothic arch analysis for more demanding applications.	Working

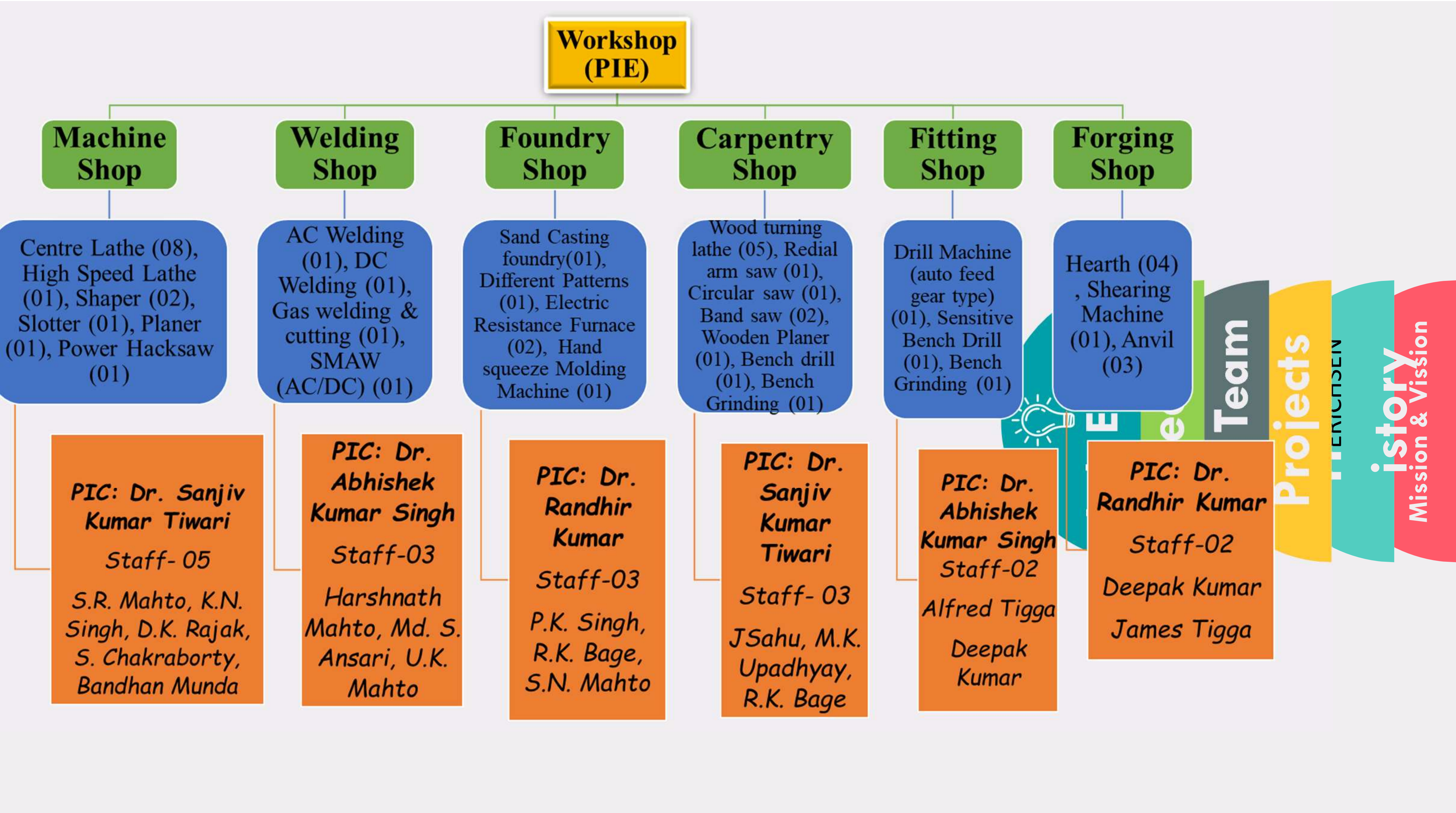

Manufacturing Process Lab (PIE)
Metal cutting Shop
CNC Wire Cut EDM, Micro Machining (Micro Tools) {01} , Turret Lathe (01), High Speed Lathe (01) , CNC Lathe (01) , CNC Surface Grinding (01), Microwave Furnace {01}, Erichsen Cupping Test (01), CNC Air plasma Cutting machine
PIC: Dr. Sanjiv Kumar Tiwari
Staff- 06
S.R. Mahto, Sohrai Mahto, K.N. Singh, D.K. Rajak, S. Chakraborty, Bandhan Munda
Metal Joining Shop
TIG/MIG Welding (01), SAW (01), SMAW (01), Spot welding (01), Gas welding & cutting (01), SMAW Welding (02)
PIC: Dr. Abhishek Kumar Singh
Staff-04
R. Nayak, H Mahto, Md. S. Ansari, U.K. Mahto
Casting Lab
Induction Furnace (01), Stir Casting & Attachment (squeeze die casting, centrifugal casting, ultra-sonic, vacuum cast, preheated oven) {01}, Permeability Meter (01), Sieve Shaker (01), Moisture and Drying test (01), Molds and Molding Tools (01) , Baking Oven (01)
PIC: Dr. Randhir Kumar
Staff-03
P.K. Singh, R.K. Bage, S.N. Mahto
Machine Automation Lab
Cylindrical Grinding (01), Gear Hobber (01), Retrofitted Lathe (01), Copy Turning Lathe (01), Single spindle turning (01), Milling use for friction stir welding (01), CNC lathe (01), 3 Axis CNC Milling (01)
PIC: Dr. Sanjiv Kumar Tiwari
Technical Staff- 02
Sohrai Mahto, M. Upadhaya, Alferd Tigga
Projects
Mission & Vision



Labs (PIE)
FMS & Robotics Lab
MS system (Automated Storage of Retrieval System) {01}, CNC urning (MTAB) {01}, CNC milling (MTAB))1}, Robotized Loading Unloading (Aristo XT obot 6axis) {01}, PLC, Simulator, H Simulator Mechatronic Kit) {01}, LSM Controller (01), ensor Kit (01), ENCO Compact 5 CNC Lathe {01}
PIC: Dr. S Datta
Staff- 02
R. Nayak, G. C. Pramanik
Modeling and Simulation Lab
NX10 Software {10 User}, Mini Tab-17 Software {10 User}, GPSS {22 User}, AFDEX {05 User}, Z-Cast {05 User}, WITNESS software {05 User}, V-CNC {05 User}
PIC: Dr. L. N. Pattanaik & S. Samanta
Staff-03
Sorhai Mahato, Kalawati Mahto, Rajendra Nayak
Work-study & Ergonomics Lab
EMG Recording system with cycle ergonomics (01), Bolt and washer assembly (01), Rope and clip assembly (01), Bracket and bolt assembly (01), Work sampling (01), Performance Evaluation by card rating (01), Drilling and chamfering operation (01)
PIC: Dr.B. Kumar
Staff-01
B. Mahato
Metallurgy and Forming Lab
Metallographic Polishing Machine (01),Optical Microscope (01), Jomny and quench (01), Muffle Furnace (04), Mold hardness tester (01), Specimen cutting machine (01)
PIC: Dr. S Datta & Dr. G. Paul
Staff- 03
B. Mahato, Arun Mahto , P. K. Singh
Metrology Lab
Slip Gauges {03}, Outside micrometer {04}, Depth and Inside Micrometer {01} , Dial Gauge {03}, Vernier Caliper {04}, Vernier Height Gauge {02}, Sine Bar {05}, Thread Micrometer {01}, Floating Carriage Micrometer {01}, Three Wire For Measuring Pitch Dia. {01}, Button Magnet {03}, Optical Flate Doall {01}, Monochromatic Light Doall {01}, Depth Gauge {01}, Profile Projector {01}, Granite Surface Plate {01}, Combination Set {01}
PIC: Dr. S Datta
Staff- 03
B. Mahato, Arun Mahto , P. K. Singh
CAM Lab
CNC Lathe (01, CNC Milling (01), CNC Air Plasma (01), CNC Surface Grinder (01), Fanuc {15 User}, Siemens {15 User}
PIC: Dr.B. Kumar
Staff- 03
Rajendra Nayak 2. G C Pramanik, Kalwati Mahato
Mission & Vision

PIE Workshop

- The Department has a workshop, which caters to all fabrication needs of entire BIT, Mesra
- We have excellent machining, welding, fitting, carpentry, and foundry facilities.
- We have several CNC machines
- We have TIG, MIG, Spot, SMAW, SAW, Gas welding setup
- We have CNC air plasma cutting machine and CNC Wire EDM machine
- We have several furnaces and ovens.
- We can carry out sand casting, stir casting, squeeze casting, Ultrasonic casting, and centrifugal casting in our foundry
- We have factory license up to 2031


Workshop (PIE)
Machine Shop
Welding Shop
Foundry Shop
Carpentry Shop
Fitting Shop
Forging Shop
Centre Lathe (08), High Speed Lathe (01), Shaper (02), Slotter (01), Planer (01), Power Hacksaw (01)
AC Welding (01), DC Welding (01), Gas welding & cutting (01), SMAW (AC/DC) (01)
Sand Casting foundry(01), Different Patterns (01), Electric Resistance Furnace (02), Hand squeeze Molding Machine (01)
Wood turning lathe (05), Redial arm saw (01), Circular saw (01), Band saw (02), Wooden Planer (01), Bench drill (01), Bench Grinding (01)
Drill Machine (auto feed gear type) (01), Sensitive Bench Drill (01), Bench Grinding (01)
Hearth (04) , Shearing Machine (01), Anvil (03)
PIC: Dr. Sanjiv Kumar Tiwari
Staff- 05
S.R. Mahto, K.N. Singh, D.K. Rajak, S. Chakraborty, Bandhan Munda
PIC: Dr. Abhishek Kumar Singh
Staff-03
Harshnath Mahto, Md. S. Ansari, U.K. Mahto
PIC: Dr. Randhir Kumar
Staff-03
P.K. Singh, R.K. Bage, S.N. Mahto
PIC: Dr. Sanjiv Kumar Tiwari
Staff- 03
JSahu, M.K. Upadhyay, R.K. Bage
PIC: Dr. Abhishek Kumar Singh
Staff-02
Alfred Tigga
Deepak Kumar
PIC: Dr. Randhir Kumar
Staff-02
Deepak Kumar
James Tigga

Some Ex-Faculties

- Dr Vijay Pandey, VC in charge, Jharkhand University of Technology
- Dr. Saranjit Singh, Pro VC, KIIT
- Dr. K Muthukumaran, Dean, NIT, Trichi
- Dr. A. N. Sinha, Prof & HOD, NIT, Patna
- Dr. Rajeev Agarwal, Asso Prof NIT, Jaipur
- Dr. S . C. Srivastava, Prof. & HOD & Controller of Examination Guru Ghasidas University
- Dr. Avnish Dubey, HOD, MNIT, Allahbad
- Dr. Prakash Kumar, Professor & HOD, BIT, Sindri
- Dr. Somanth Chattopadhaya, Asso. Prof. ISM, Dhanbad


Research
PIE Department
START

ALUMINIUM METAL MATRIX COMPOSTE FOAM MATERIAL

AUTHORS

Dr. Joyjeet Ghose, Associate Professor, Department of PIE, BIT, Mesra

Dr. Vinay sharma, Professor, Department of PIE, BIT, Mesra

PROJECT: AICTE NCP DEFORMATION AND FRACTURING BEHAVIOUR OF METALLIC FOAMS, 20L, 2006

Patent: Aluminium Metal Foam and a process for Preparation thereof

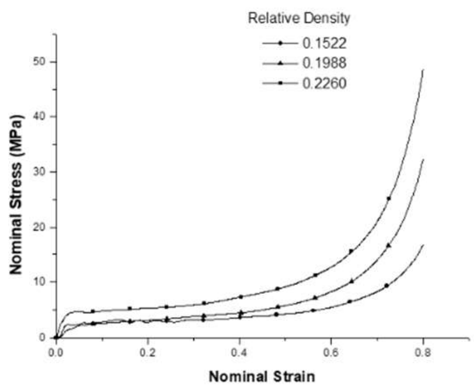
Patent grant date 09.06.2020. Indian Patent vide no. 338236 inventors: Dr. Joyjeet Ghose Dr. Vinay Sharma and Dr. Surender Kumar

INTRODUCTION

METAL FOAM IS A TYPE OF SOLID FOAM. THEIR CELLS CONSIST OF INTERCONNECTED NETWORKS OF LIGAMENTS, MEMBRANES, PLATES OR SHELLS, WHICH FORM THEIR EDGES AND FACES. METAL FOAM IS THUS POROUS MATERIAL WITH A CELLULAR STRUCTURE AND THEREFORE, IS ALSO CALLED CELLULAR SOLIDS PROPERTIES REVEAL POTENTIAL OF ALUMINUM FOAMS IN WIDE RANGE OF APPLICATION. HENCE, IN THIS WORK ALUMINUM HAS BEEN SELECTED AS THE BASE METAL FOR PRODUCTION OF METAL FOAM.

Image demonstratinfg that aluminium foam is lighter than water.

THE EXPERIMENTAL SETUP FOR THE PRODUCTION OF ALUMINUM FOAM IS DESIGNED AND FABRICATED. INVESTIGATION ARE MADE INTO THE USE OF DUAL FOAMING AGENTS (I.E. TIH2 AND CACO3) ALONG WITH SIC TO DEVELOP SUITABLE ALUMINUM FOAMS WHICH CAN BE UTILIZED FOR VARIOUS ENGINEERING PRODUCTS LIKE SOUND ABSORBING MATERIALS, LOAD BEARING ELEMENTS, CRASH RESISTANCE ELEMENTS



Stress–Strain curves of aluminum foam under uniaxial compression

Optical microscopy image of aluminum foam at 12x magnification. Such Aluminium foam has properties, which make them suitable for structural, energy absorption and acoustic applications.

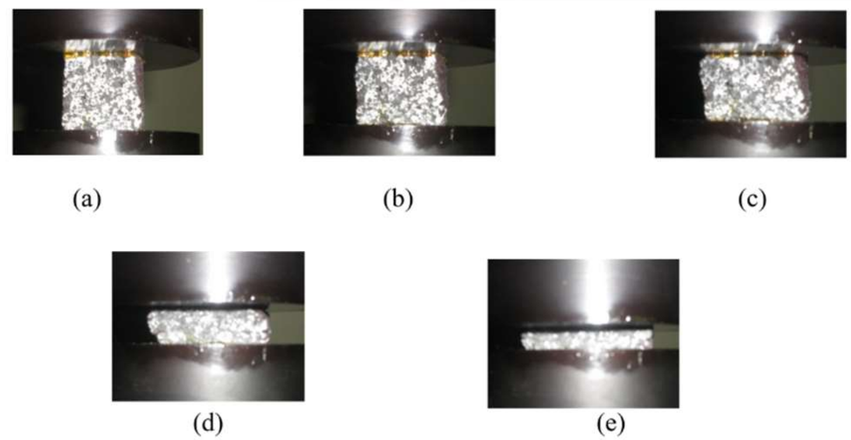


Fig.: Images taken during compression test of aluminum MMC foam (Relative density 0.1988) (a) 2% strain, (b) 10% strain, (c) 20% strain, (d) 60% strain, (e) 80% strain

ALUMINIUM METAL MATRIX NANO COMPOSTE MATERIAL

AUTHORS

Dr. Joyjeet Ghose, Associate Professor, Department of PIE, BIT, Mesra

Dr. Bappa Acherjee, Assistant Professor, Department of PIE, BIT, Mesra

PROJECT

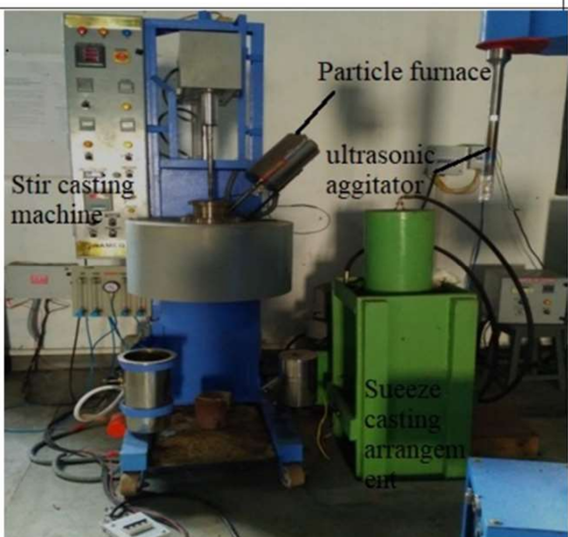
DST SERB, 40Lac, CRG, Jan 2022, 3 years

INTRODUCTION

- THERE IS A LONG-STANDING DEMAND FOR LIGHT WEIGHT, HIGH STRENGTH, WEAR RESISTANT ALUMINIUM ALLOYS PARTICULARLY IN THE AUTOMOTIVE INDUSTRIES.
- INCREASED USED OF ALUMINIUM AS FUNCTIONAL COMPONENTS FOR AUTOMOTIVE APPLICATIONS
- ALUMINIUM COMPOSITES HAS DESIGNED PROPERTIES, WHICH MAKE IDEAL MATERIAL
- HYBRID COMPOSITES FURTHER INCREASES THE FUNCTIONALITY OF THE MATERIAL

Objectives

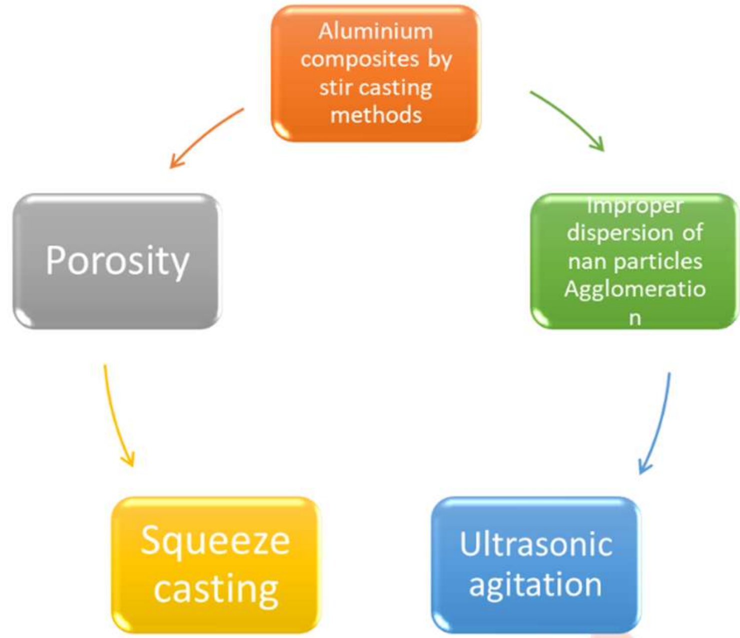
- TO PRODUCE HYBRID ALUMINIUM NANO-METAL MATRIX COMPOSITE
- CARRY OUT MECHANICAL, PHYSICAL AND METALLURGICAL CHARACTERIZATION
- **THIS WORK AIMS TO MANUFACTURE AN AUTOMOTIVE CAM MADE OF HYBRID ALUMINIUM NANO-METAL MATRIX COMPOSITE AND CARRY OUT TEST TO MEASURE THE PERFORMANCE OF THE DEVELOPED MATERIAL.**



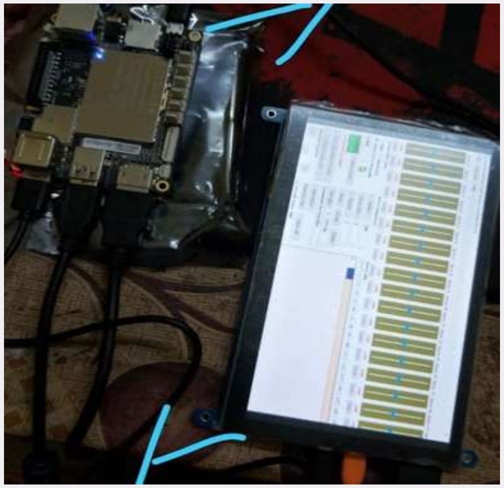
- Base material: AA6061,
- Reinforcement materials:

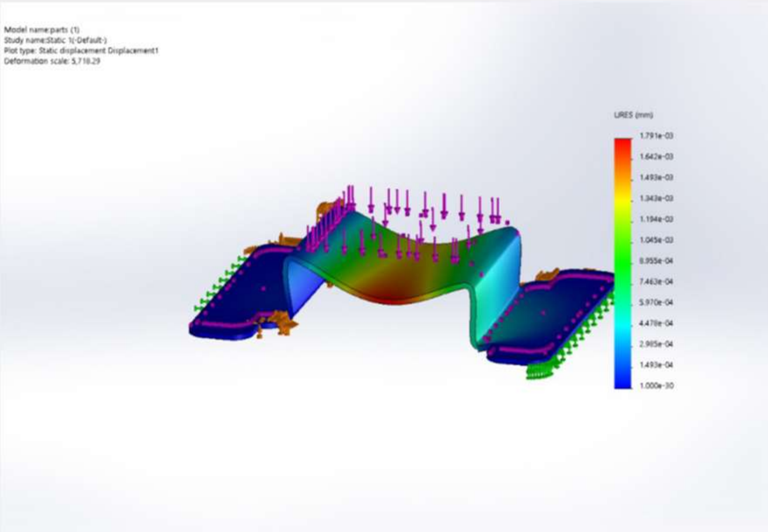
Nano size B4C particles

Nano size graphite particles



Design and development of an IoT based intelligent control system for a 6 dof robot arm (IEI Project)- Completed

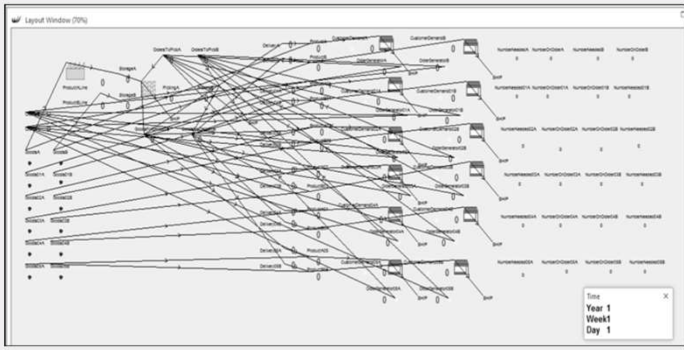


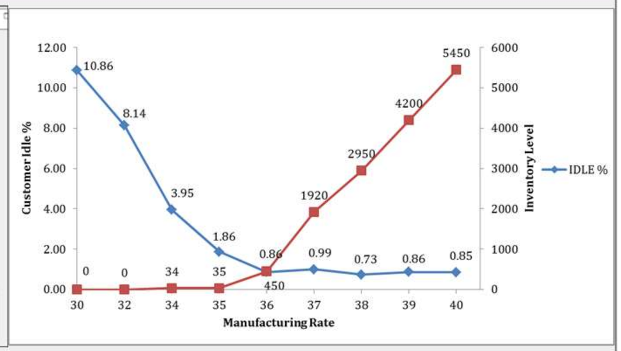


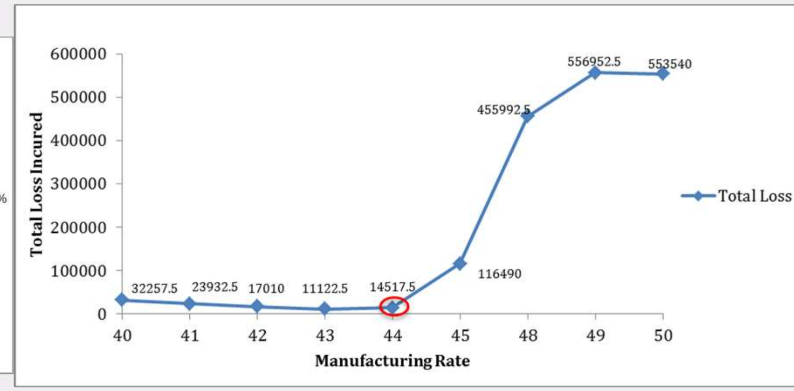
This project was

- To develop a truly autonomous robotic control system that can be controlled and monitored from anywhere with a device having internet connectivity
- A manipulator that is redundantly aware of its surrounding
- All the communications are handled by industry standard IEEE 802.11 Wireless LAN & MQTT.
- The position control system is to be integrated with the IoT gateway/controller which will essentially act as a server responding to requests from clients.

Simulation (WITNESS software) Optimization of a reconfigurable supply chain
(BTech Project based publications)







A reconfigurable supply chain model was developed and simulated for optimization of production rate (takt time) under dynamic demand conditions. Two objective functions were formulated; supply chain costs and reliability of suppliers.

Design and optimization of reconfigurable assembly line **(latest PhD awarded)**

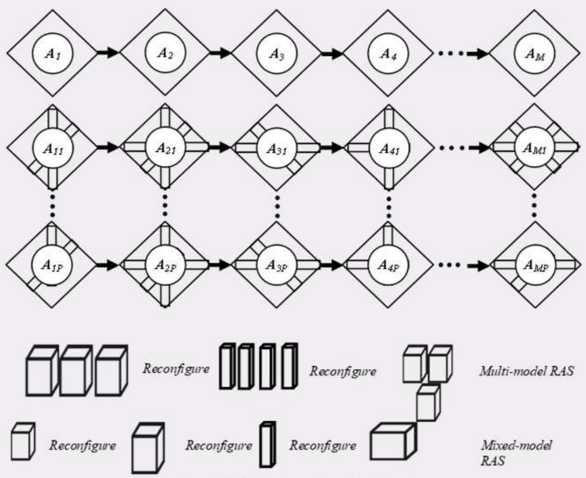
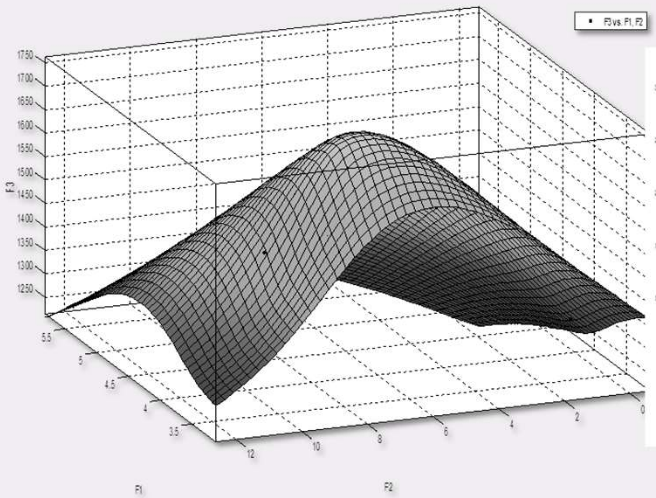
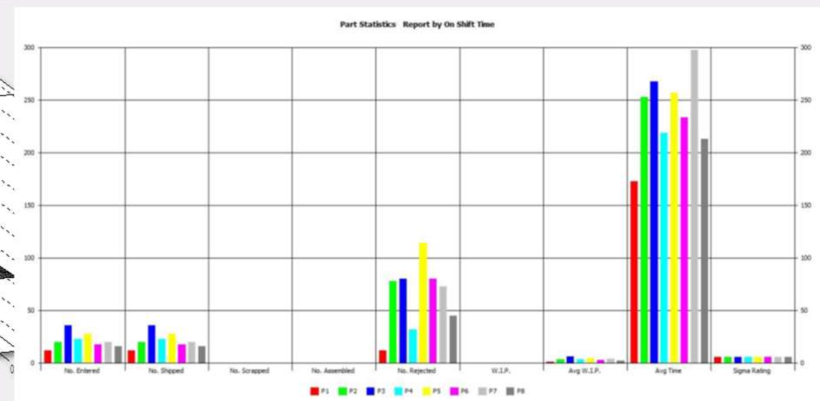


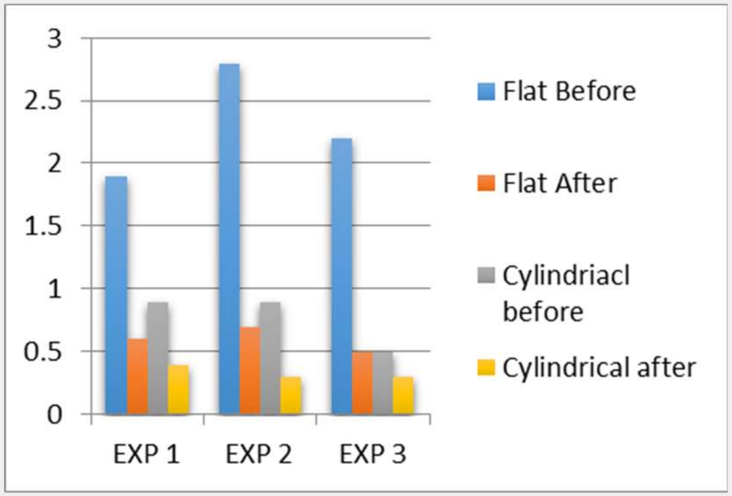
Figure 1. Idealized model of an RAS





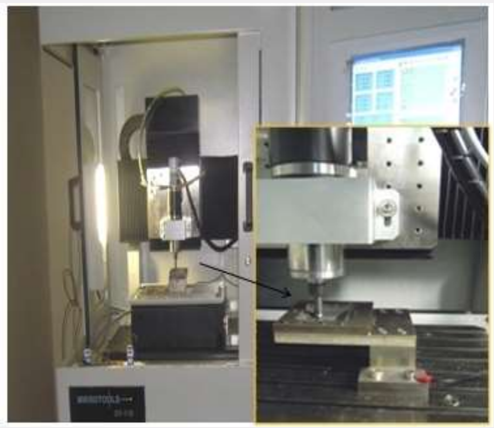
- A multi-objective optimization approach using MOSOMA metaheuristic for a model of reconfigurable assembly lines. A novel work published in IJAMT (SCI IF 3.32) compared the performance of mixed-model vs multi-model RAS
- A selection method for best solution from multiple Pareto solution is proposed.

Development of Magnetorheological Finishing (MRF) Process For non-magnetic Freeform work **(MTech dissertation based publications)**

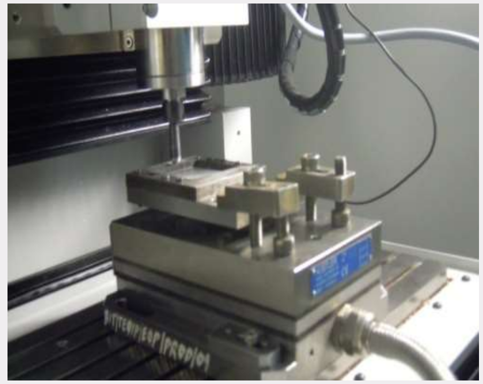


An experimental set-up developed for conducting a Magnetorheological Finishing (MRF) process on copper workpiece material. Improvements in surface finish and the effect of surface profile on surface finish are reported.

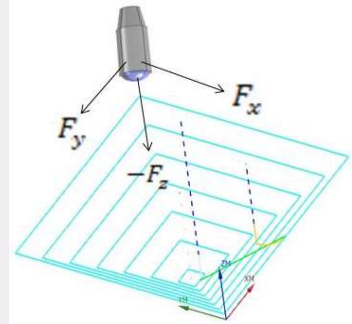
Incremental sheet metal forming

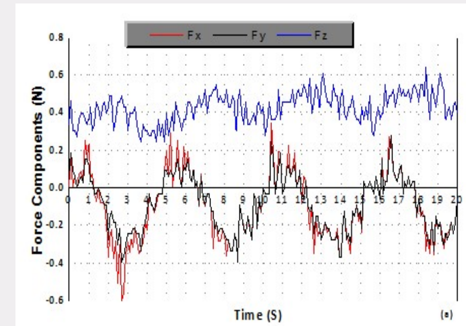


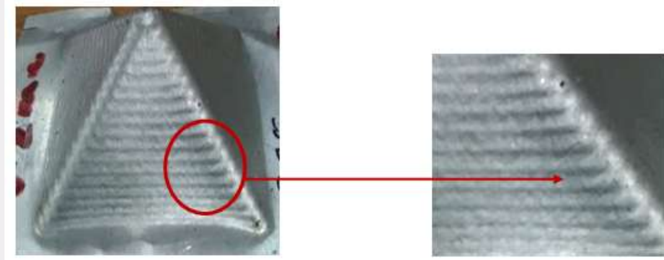
ISMF Set-up in Mikrotool DT 110

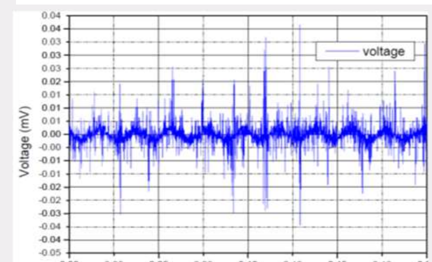


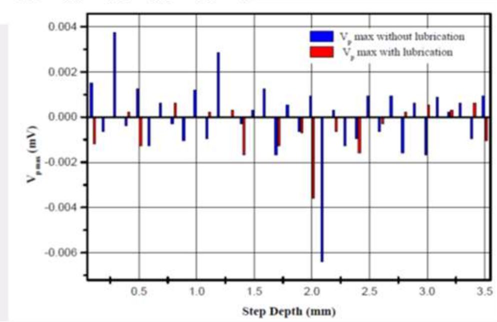
Kristler 9265B six-component force dynamometer

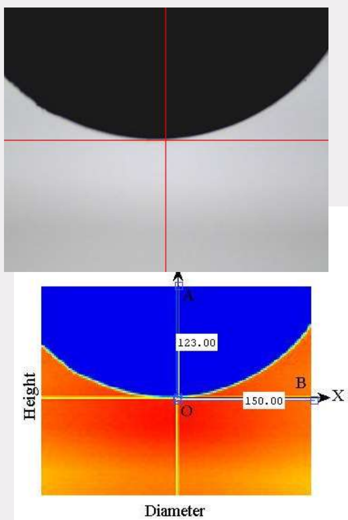


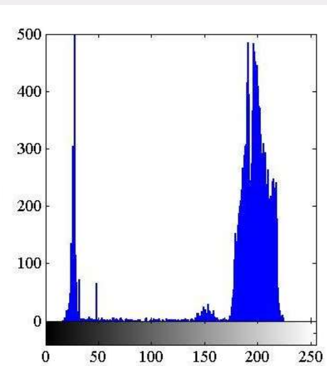




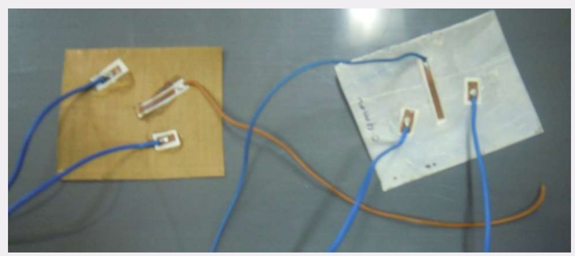


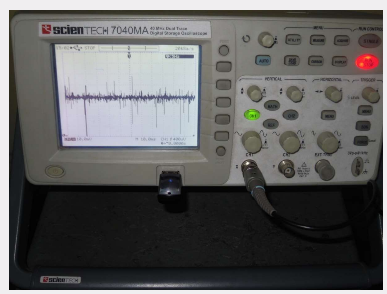






Tool Wear Analysis





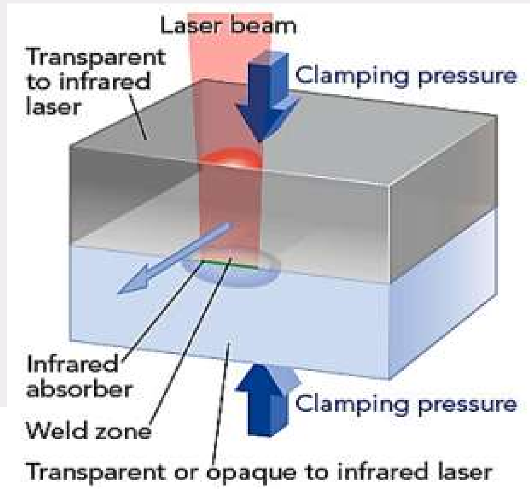
EMR Radiation during metal deformation

Dr. Bappa Acherjee, Assistant Professor

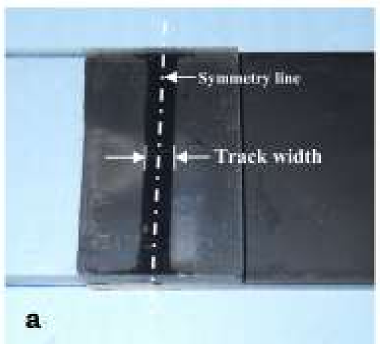
Research Highlights

AREA OF RESEARCH

- Laser Material Processing,
- Advanced Welding Technologies,
- Micro-manufacturing,
- Modeling and Simulation of Manufacturing Processes,
- Decision Engineering

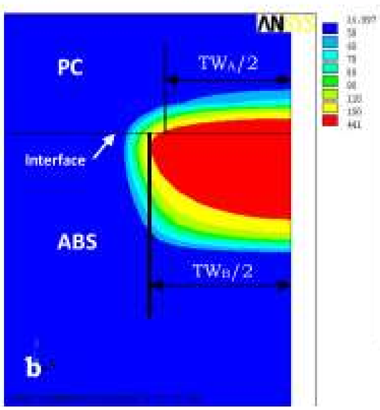


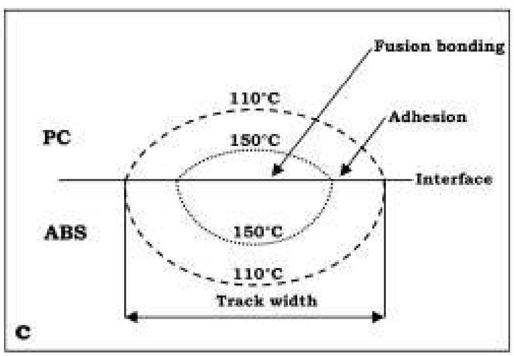
Laser Transmission Welding



Empirical Modeling and Multi-Response Optimization of **Laser Transmission Welding** of Polycarbonate to ABS

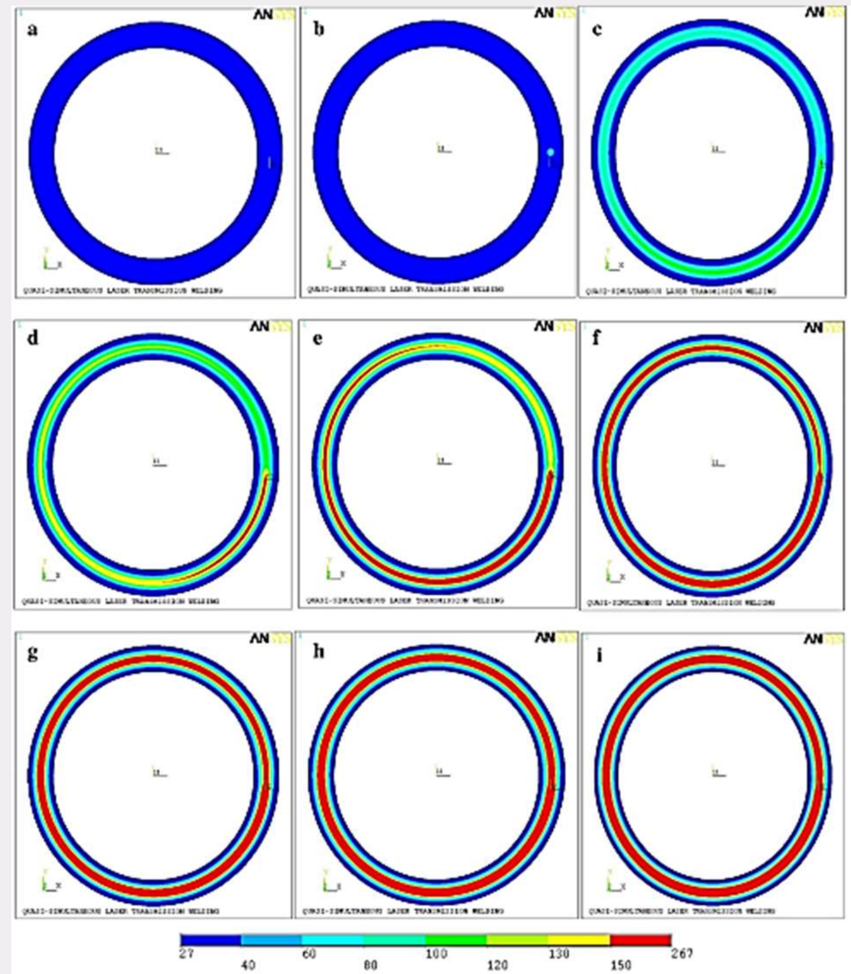
Lasers Manuf. Mater. Process. (2015) 2:103–123





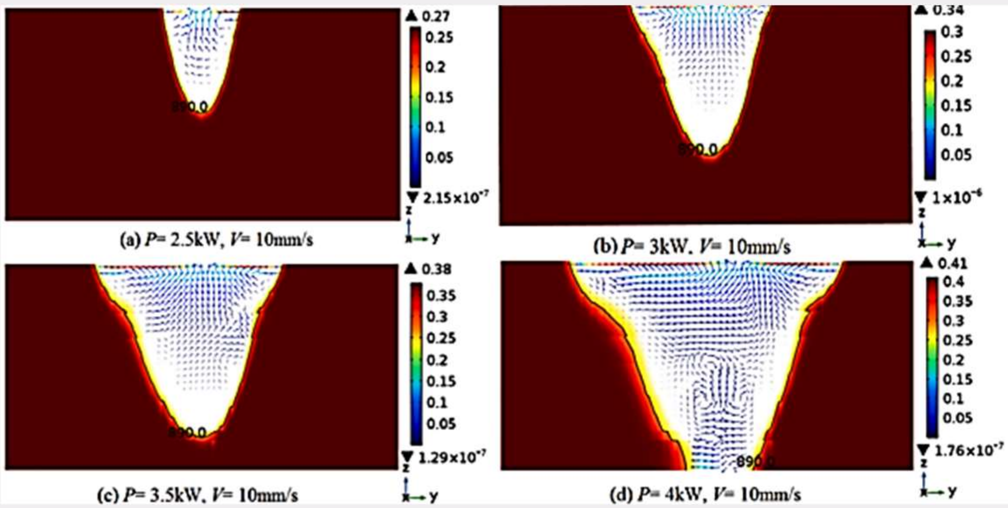
3-D FE heat transfer simulation of **quasi-simultaneous laser transmission welding** of thermoplastics

(Journal of the Brazilian Society of Mechanical Sciences and Engineering (2019) 41:466)



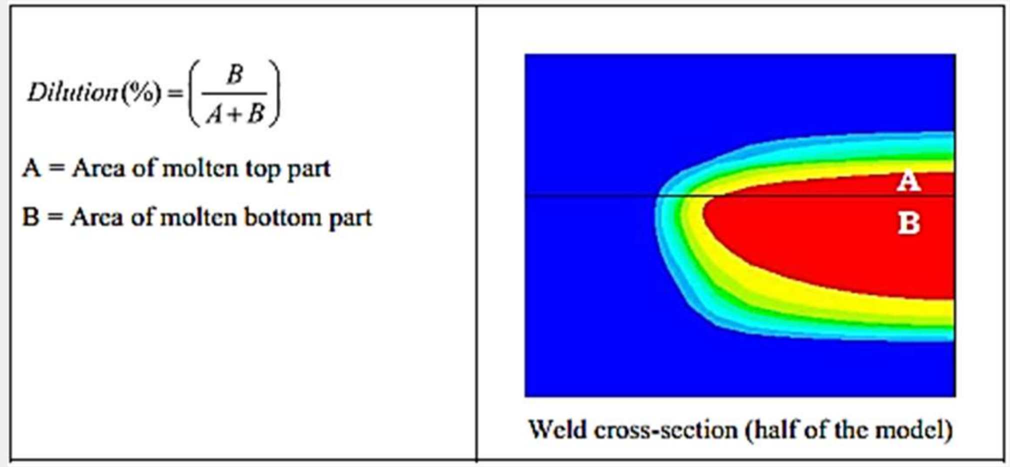
Numerical simulation of the temperature field, weld profile, and weld pool dynamics in **laser welding of aluminium alloy**

Optik - International Journal for Light and Electron Optics 247 (2021) 167990



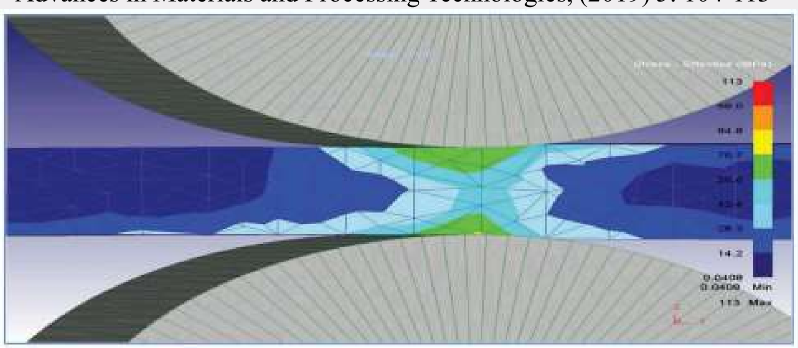
Laser transmission welding of dissimilar plastics: 3-D FE modeling and experimental validation

Welding in the World (2021) 65:1429–1440



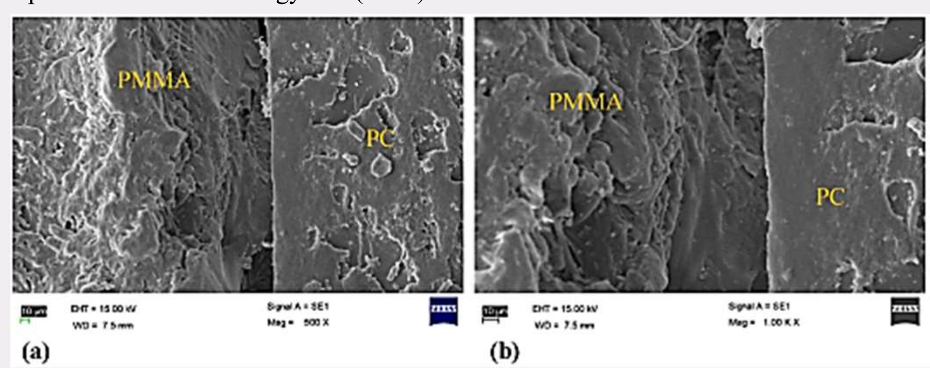
Process modelling of **flat rolling of steel**

Advances in Materials and Processing Technologies, (2019) 5: 104-113



Beam wobbling effects on **laser transmission welding of dissimilar polymers**: Experiments, modeling, and process optimization

Optics & Laser Technology 146 (2022) 10760



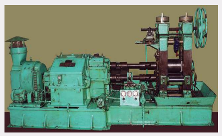
Semi-Solid Metal Processing : Strain Induced Melt Activation Process (SIMA)

Author: Dr. Randhir Kumar, Assistant Professor, Dept. of PIE BIT Mesra.



A356 alloy Ingot Electric Resistance Furnace





As Cast A356 Al-alloy sample **Rolling M/C**

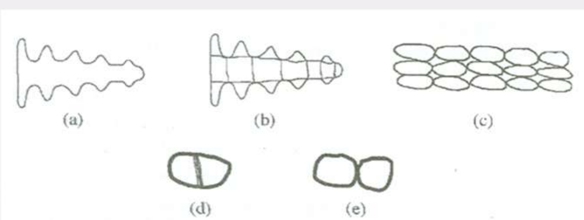


Strain induced Sample Heat Treatment Furnaces Optical Microscope



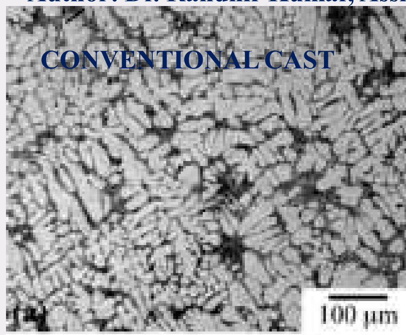
HOUNSFIE D UTS M/C **JEOL SEM M/C** **Wear Test M/C**

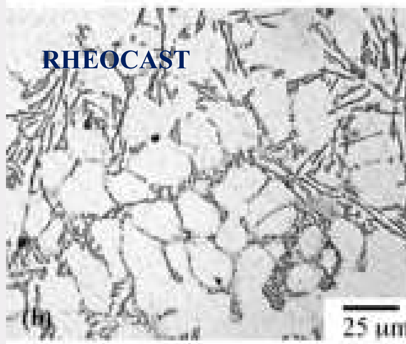
Illustration of microstructure evolution model for SIMA:



(a)initial dendrite fragment (b) dendrite growth

(c) rosette (d) ripened rosette and (e) spheroid





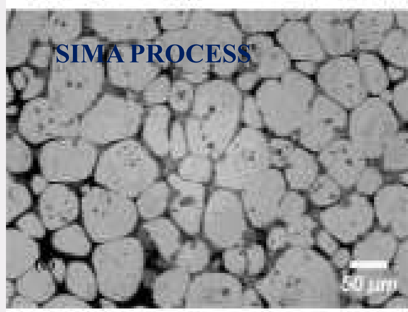


Fig. 1 : Optical microscopy of A356 samples: (a) conventional cast, (b) rheocast and (c) SIMA processed sample (80% deformation; 580°C, 1h).

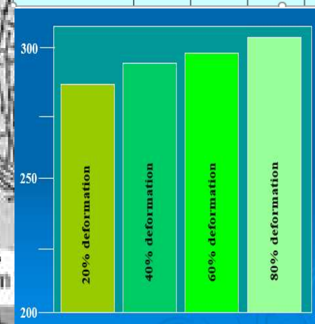
Ultimate tensile strength (UTS) and elongation (El%) of A-356 alloy at various treatment conditions.

Conventional cast samples: UTS = 140 MPa, El = 6.5%

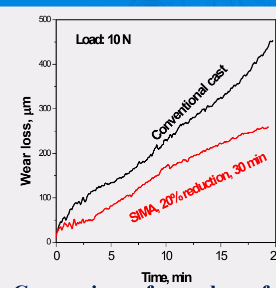
Rheocast samples: UTS = 210 MPa, El = 8.2%

As-rolled and strain induced melt activation samples:

% deformation	20%		40%		60%		80%	
	UTS (MPa)	El%	UTS (MPa)	El%	UTS (MPa)	El%	UTS (MPa)	El%
As-rolled samples	149	10.9	157	10.8	159	10.7	180	9.40
SIMA, 15 minute	230	10.0	272	14.0	284	19.2	286	20.4
SIMA, 30 minute	286	10.0	297	14	300	16.8	305	20.0
SIMA, 1 hour	**290**	**12**	**294**	**14**	**298**	**14**	**310**	**18**
SIMA, 2 hour	282	11.5	285	13	292	13.2	294	16.4



Histogram showing differences in UTS for SIMA samples at 540°C for 30 minutes.



Comparison of wear loss of SIMA & conventional cast alloy

Major Alloy Element in A356 Al-alloy

Elem.	Wt.(%)
Si	7.22
Mg	0.45
Fe	0.15
Mn	0.01
Ti	0.13

Major advantages of Semi-Solid Metal Processing over the conventional casting are as follows:

- Outstanding material properties.
- Virtually porosity and inclusion-Free.
- High strength and ductility.
- Possible in-situ recycling.
- Heat-treatable.
- Weldable.
- Ability to cast thin wall and rangy section parts.
- Longer die life.
- Less thermal cycling.
- Casts foundry and wrought alloys.
- Geometrical and alloy flexibility (aluminium alloys and magnesium alloys).

Automotive Application of A356 Al-alloy:

- Wheels,

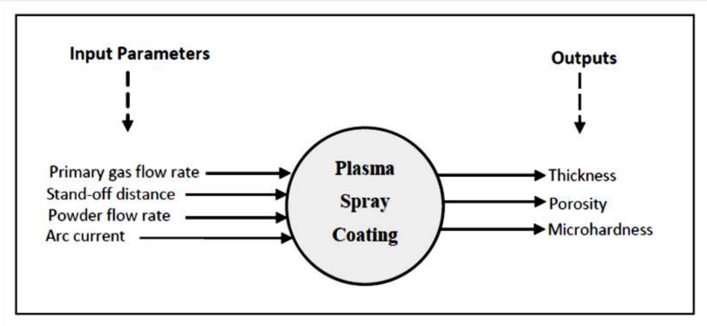
- Cylinder heads

- Manifolds

Research Area: Surface Coatings by ***Dr. Somak Datta***

• Plasma Spray Coating

Plasma spray coating is a process where finely divided metallic and non-metallic materials are deposited in a molten or semi-molten state on a prepared substrate to form a sprayed deposit. The quality of coating depends on both coating material as well as process parameters.



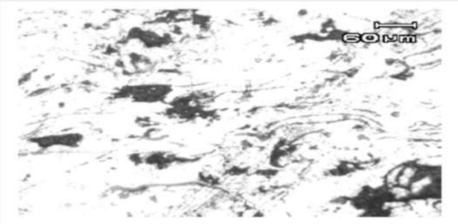
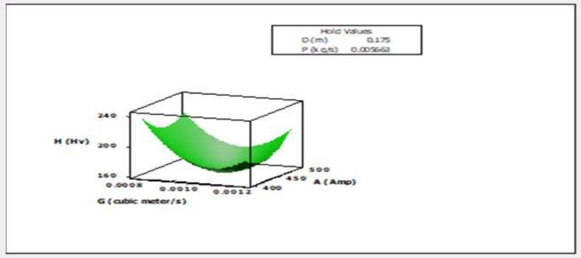


Fig. cross section of coated sample



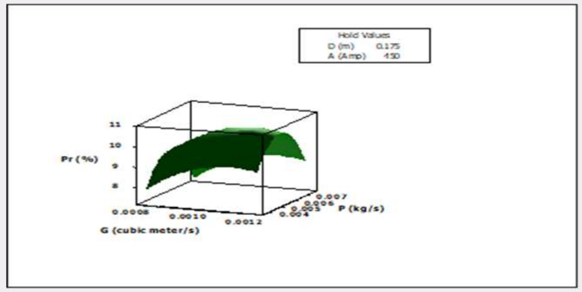
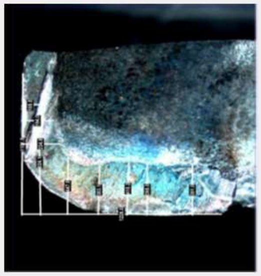


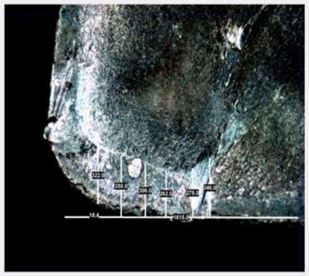
Fig. Relationships among process parameters and outputs: representative Surface Plots

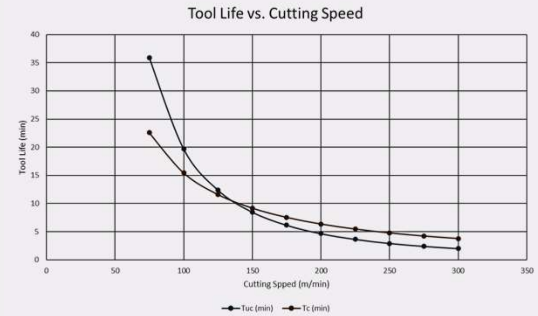
The responses can be represented as non-linear functions of input parameters. The effects of process parameters on the responses can be visualized through surface plots.

Diamond Like Carbon (DLC) coating

Comparative study of Diamond Like Carbon (DLC) coated and uncoated Carbide Tool insert







Experimentation by sputtering technique, Analysis of the hardness of the film, deposition rate, uniformity of coating and thickness of film for different process parameters.

Forward and Reverse Modeling of Manufacturing Processes using Soft Computing-based approaches

Artificial Neural Network-based modeling

The shortcoming of statistical regression or fuzzy logic-based modeling is that only one response at a time can be considered in both the approaches. Such approaches cannot capture the dynamics of the process fully. All the responses can be considered together in ANN architecture. Moreover, both forward and reverse modeling can be done using neural networks.

Models developed for atmospheric plasma spray coating process, trained, validated and optimized using GA, PSO tools.

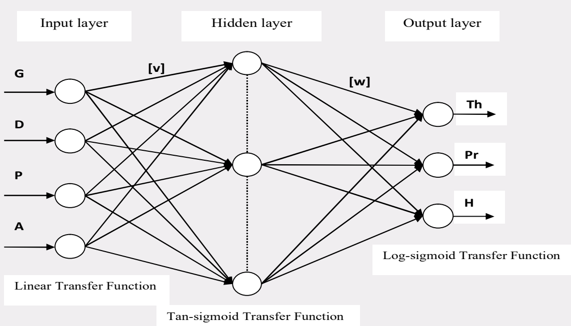


Fig: Schematic view of MLFFNN used for forward modeling.

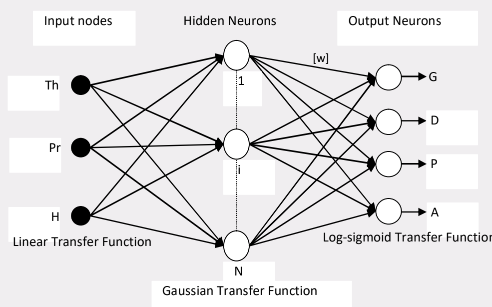


Fig: Schematic view of RBFNN used for reverse modeling

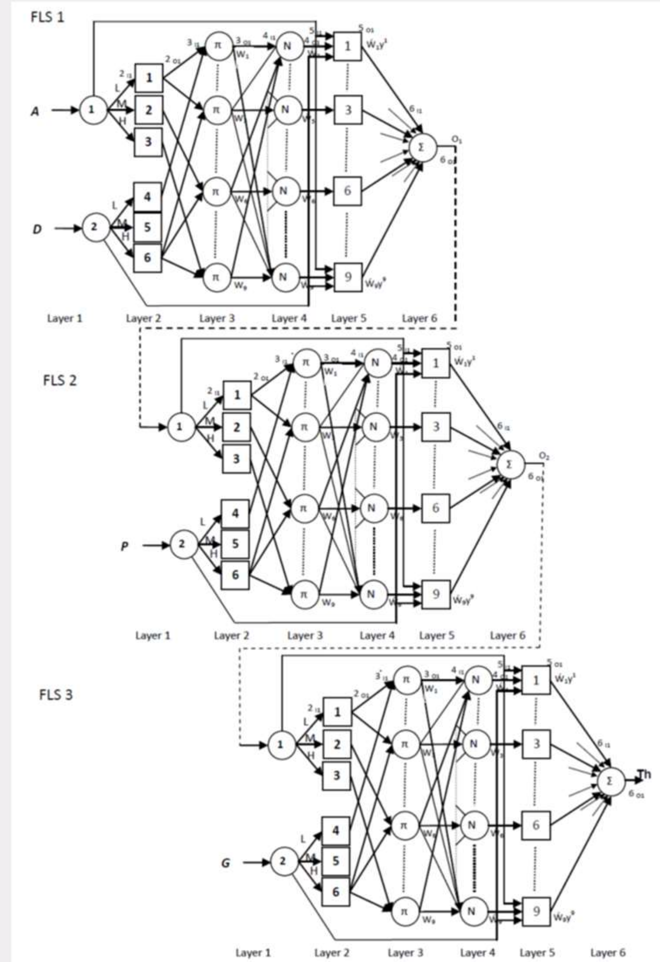
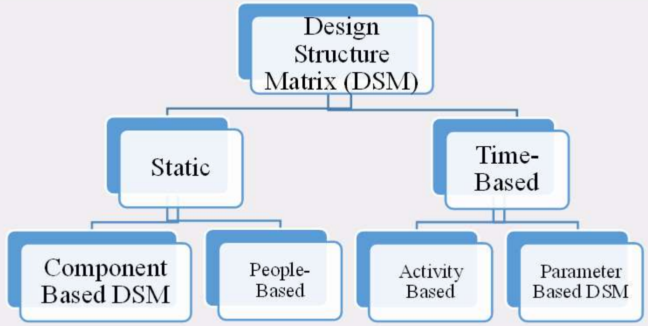
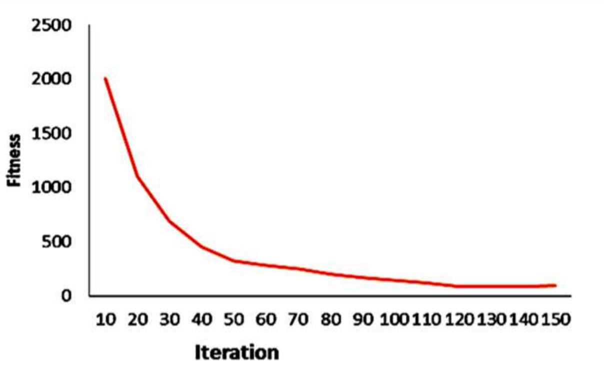
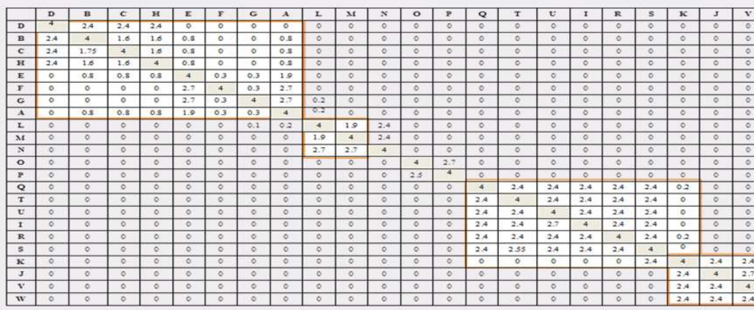


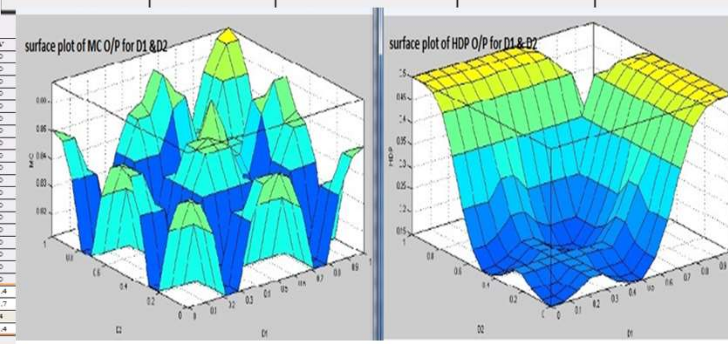
Fig: Structure of hierarchical model of ANFIS to predict coating thickness.

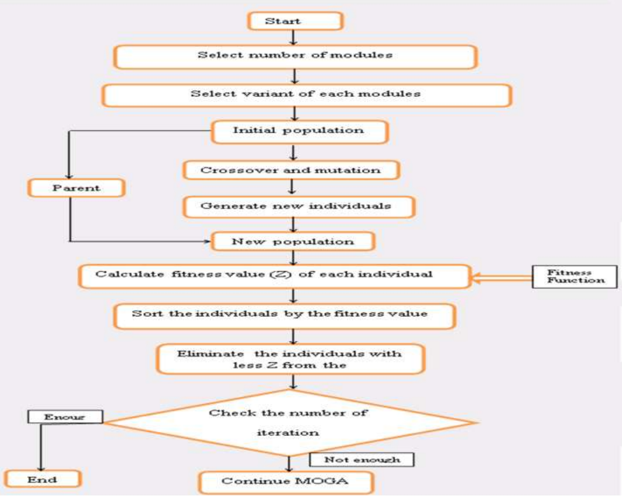
PRODUCT PLATFORM AND PRODUCT MODULARITY BASED PRODUCT DEVELOPMENT

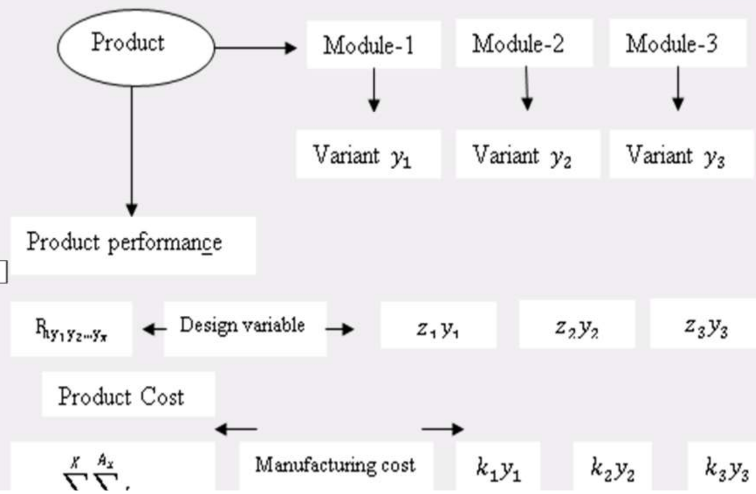


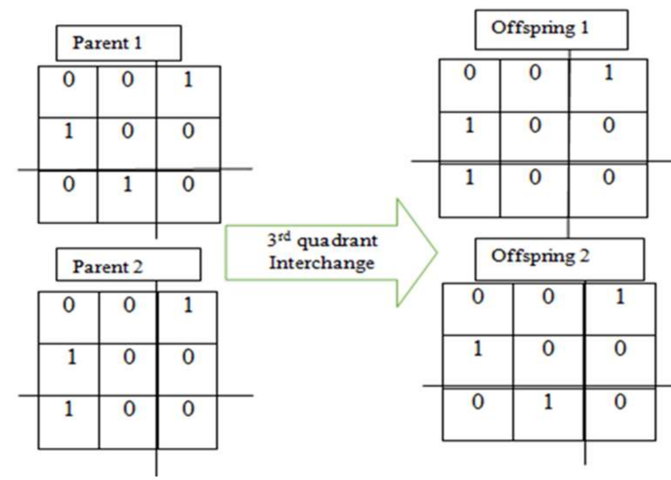






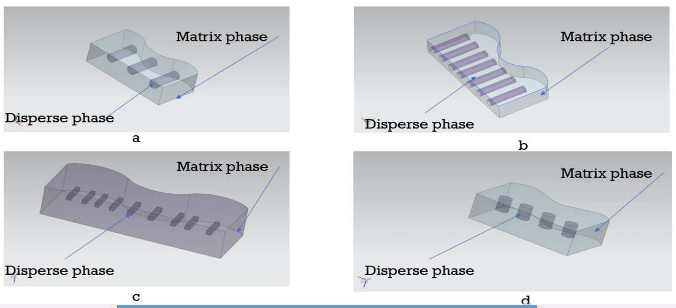




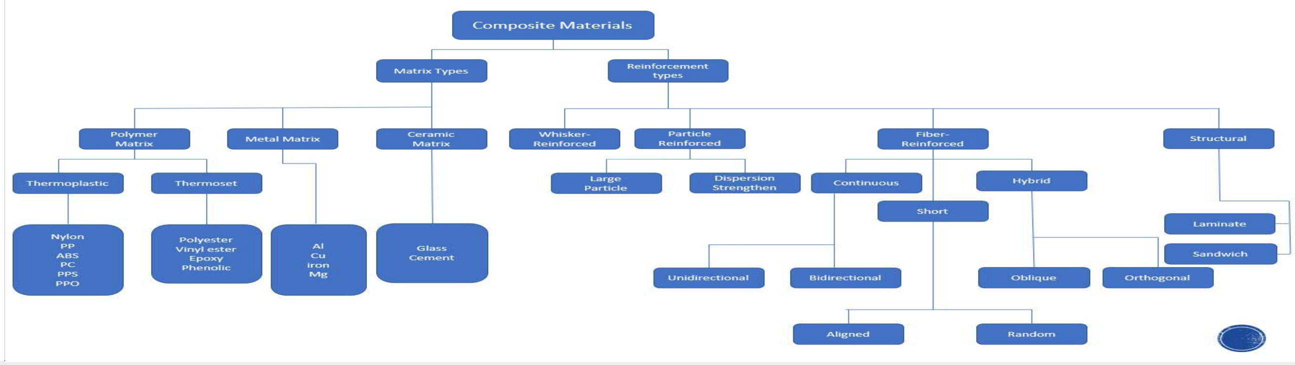


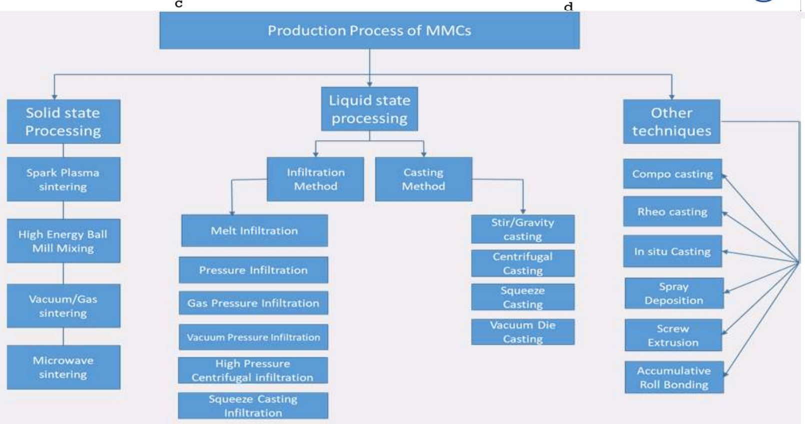
Development & Studies of Hybrid Aluminum Metal Matrix Composites for Industrial Application

- Composite Material:



- Classification of composite material:





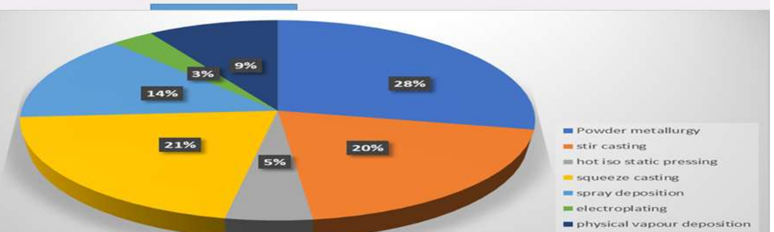


Figure:P. Venkateshwar Reddy et al. (2020), Percentage usage of various fabrication methods during the past 15 years

STIR CASTING

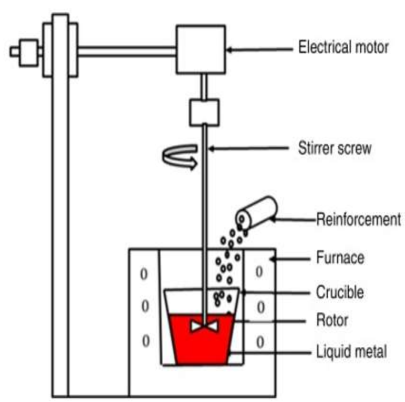


Figure: Satish Kumar Thandalam (2015), Schematic diagram for stir casting process.

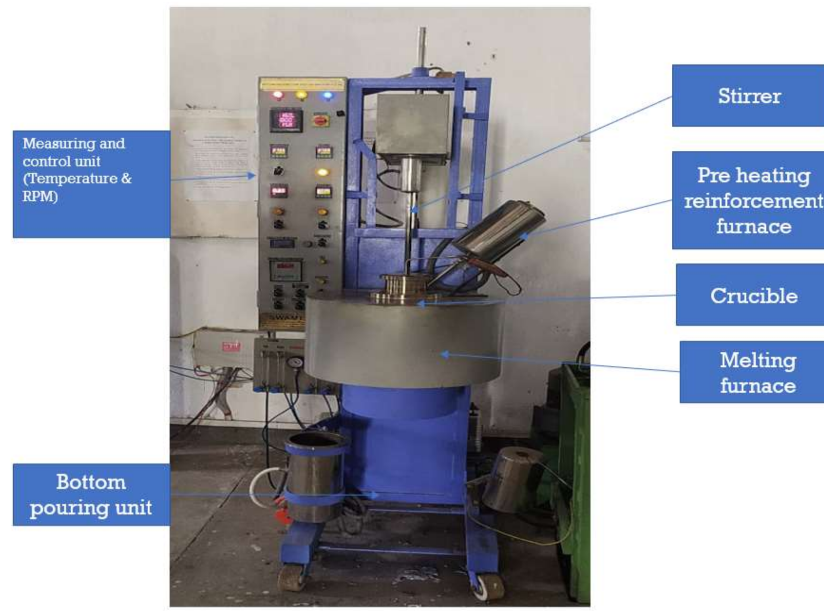
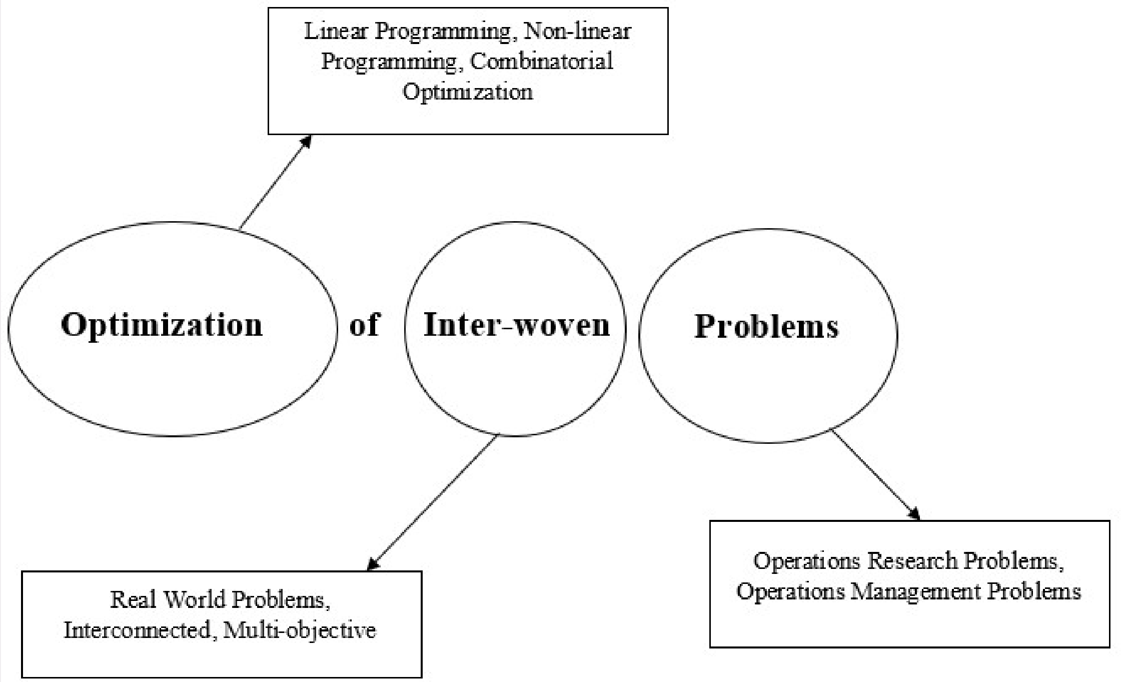
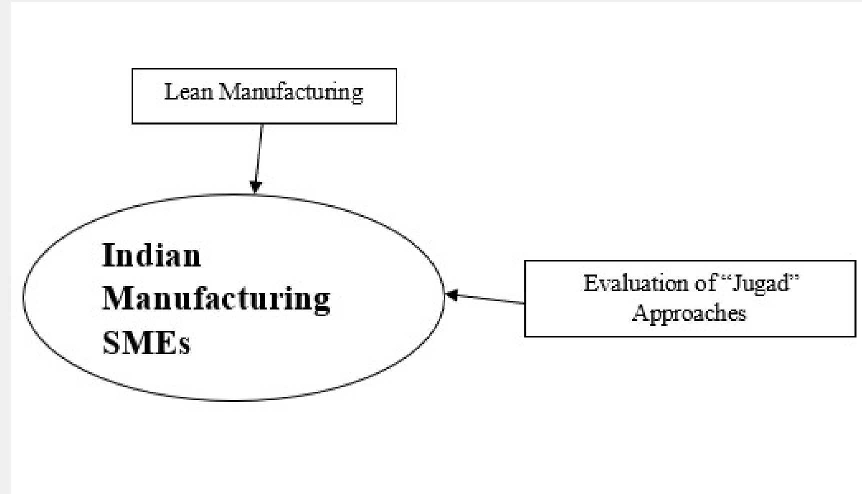


Figure: Setup of stir casting

Optimization of Inter-Woven Problem (Real world interconnected multi-objective problem)





Minimize {J1, J2} (5)

Where:

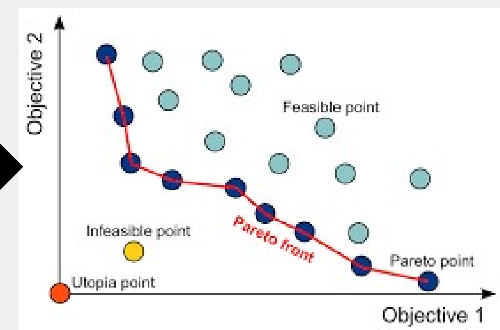
$$J1 = 1 + (phi1(1,2) - phi1(s_1, s_2))^2 + (phi2(1,2) - phi2(s_1, s_2))^2$$

$$J2 = (s_1 + 3)^2 + (s_2 + 1)^2$$

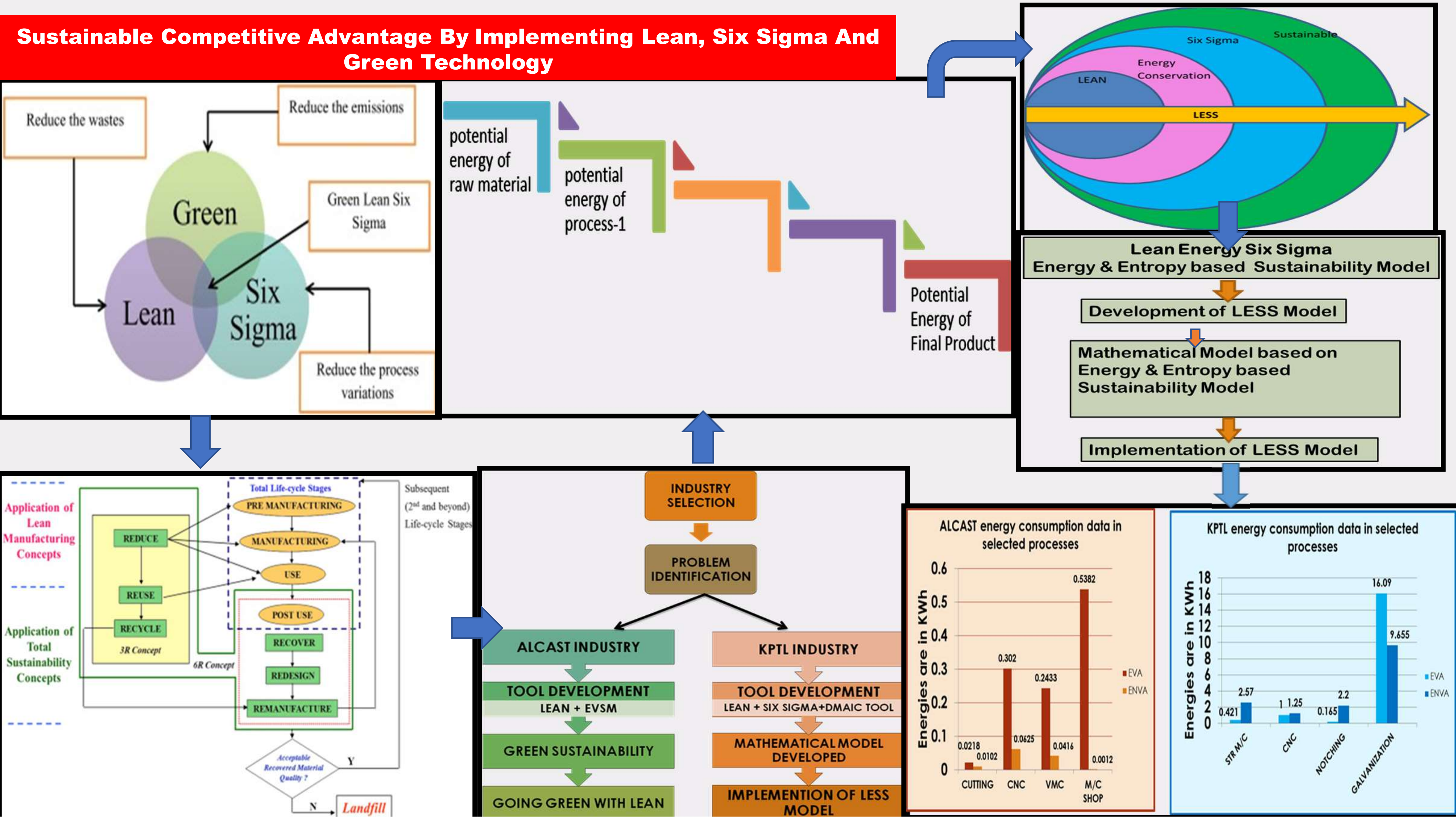
$$phi1(s_1, s_2) = \frac{1}{2}\sin(s_1) - 2\cos(s_1) + \sin(s_2) - \frac{3}{2}\cos(s_2)$$

$$phi2(s_1, s_2) = \frac{3}{2}\sin(s_1) - \cos(s_1) + 2\sin(s_2) - \frac{1}{2}\cos(s_2)$$

Subject to: $-\pi \leq s_1, s_2 \leq \pi$



Sustainable Competitive Advantage By Implementing Lean, Six Sigma And Green Technology



Dr. Gayatri Paul

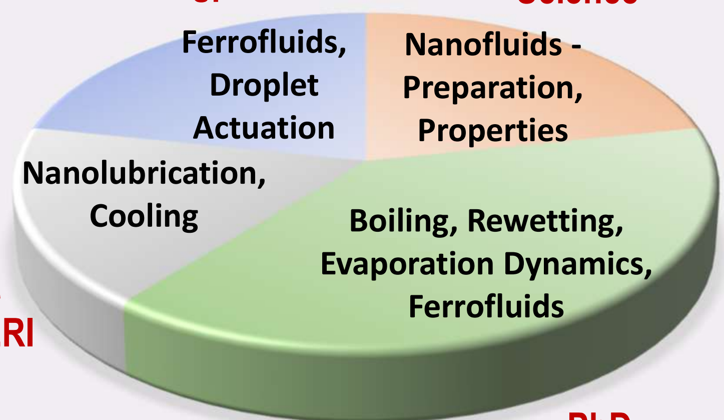
Designation: Assistant Professor

Date of Joining: 17 August 2021

Research Interests and Experience

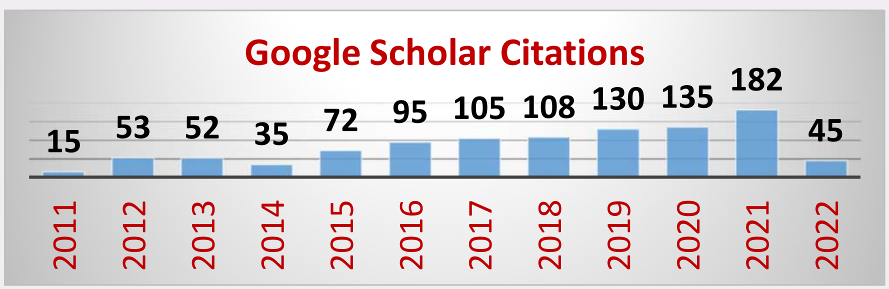
Institute PDF at IIT Kharagpur

Master of Science



NPDF at CSIR-CMERI

PhD



Current Research Interests

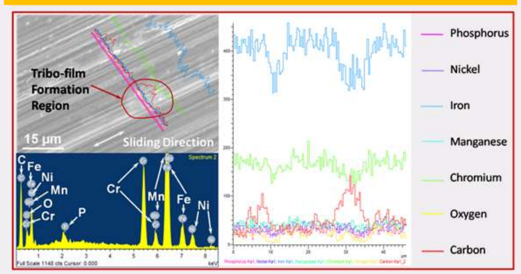
- ❑ Nanolubrication, Tribology and Wear
- ❑ Casting of Metal Matrix Composites
- ❑ Nanofluids, Minimum Quantity Lubrication

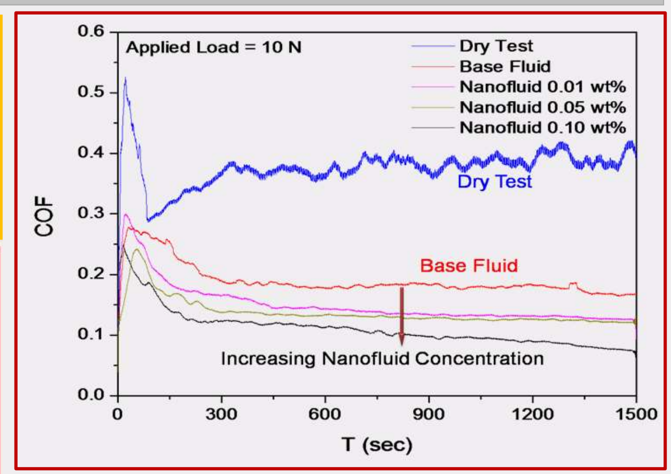
Projects Completed, Ongoing and Submitted

- ❑ SERB – NPDF (Rs. 19.2 lakhs) (Completed)
- ❑ BIT Seed Money Scheme (Rs. 5 lakhs) (Ongoing)
- ❑ SERB – POWER Scheme (Rs 30 lakhs) (Submitted)
- ❑ SERB – SRG (Rs. 33 lakhs) (Submitted)

Previous Research on Nanolubricants

Objective: To reduce coefficient of friction by dispersing nanoparticles in conventional lubricants

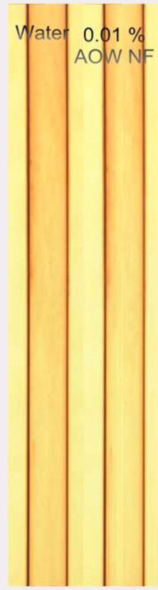




Paul et al., Tribol. Int. (2019), Nanoscale (2019)

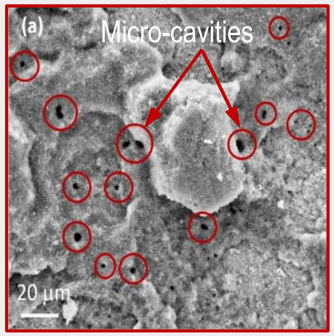
Thermal Applications of Nanofluids

- Solid-liquid contact at a higher superheat prohibited due to vapor layer formation
- With time, vapor layer collapses resulting in increased heat transfer
- Re-establishment of solid-liquid contact called **rewetting**

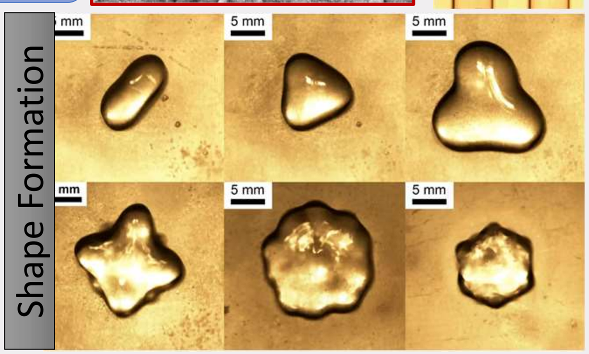


Faster rewetting using nanofluids in comparison to water leads to higher rates of heat transfer

Augmented heat transfer by nano-particle deposition on the tube and formation of micro-cavities interfere with the vapor layer dynamics



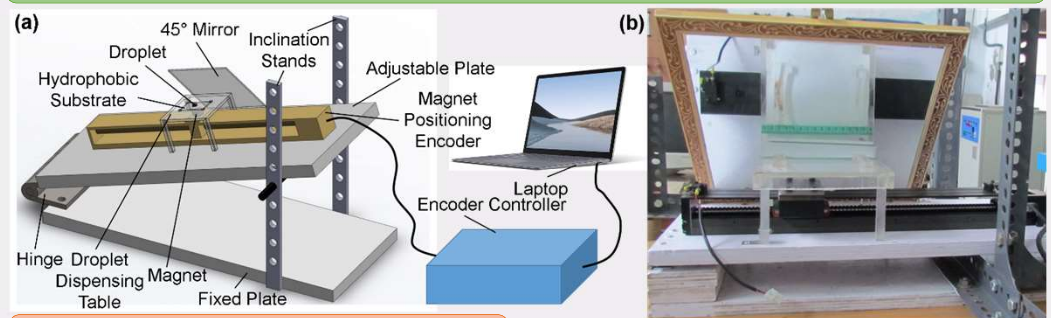
Liquid drops which levitate over its own vapor film when exposed to very hot surfaces thus decreasing the evaporation rate of liquid are called **Leidenfrost drops**



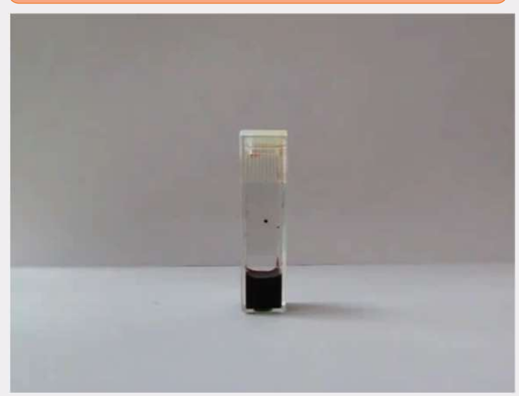
Rise in Leidenfrost temperature using nanofluids is due to the interplay between capillary and vapor forces causing the rupture of vapor film. This causes delayed film boiling and enhances heat transfer rate

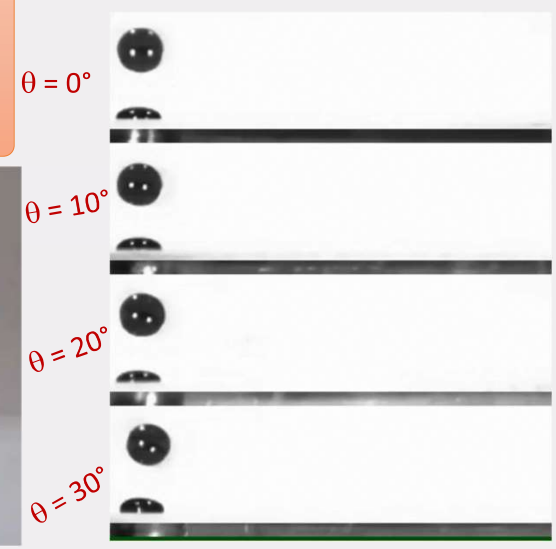
Droplet Manipulation of Ferrofluids

- Ferrofluids are magnetic nanoparticles dispersed in base fluid
- Objective: To manipulate ferrofluid droplets by external magnetic field
- Unique pearling phenomenon observed in presence of external field
- Intended applications in microfluidics, lab-on-a-chip



Ferrofluids can be controlled externally by a magnet and behaves as a liquid when the field is withdrawn






Happy Holi!
2022
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सा विद्या या विमुक्तये
RANCHI
Department of Production &
Industrial Engineering
BIT, Mesra

THANK YOU

DEPARTMENT OF PIE