Five-Days National Workshop

on

Materials Characterization and Sustainable Additive Manufacturing (MCSAM-2025)

During

3rd June – 7th June, 2025

(Virtual Mode)

To be Organized by

Department of Mechanical Engineering
National Institute of Technology
Rourkela, Odisha - 769008
www.nitrkl.ac.in

ELIGIBILITY

The workshop is open for faculty members, research scholars, UG/ PG students, personnel from R&D sectors/ research laboratories, Industry personnel (Bureaucrats/ Technical staff members) and student/ faculty/ staff members of NIT Rourkela.

REGISTRATION DETAILS

Course Fee (Including GST)
Personnel from Industry and R&D units:
Rs. 1000/-
Faculties/ Research Scholars/ Students/ Technical Staff Members of academic institutions/ research laboratories:
Rs. 500/-

Mode of Payment
Interested participants are required to send the scan copy of the Registration Form through e-mail. Online payment **should be made in favor of**:
Account Name: **CONTINUING EDUCATION NIT ROURKELA**
Payable Bank/ Branch: SBI, NIT Campus, Rourkela-769008
Account No.: **10138951784**
IFSC Code: **SBIN0002109**
MCIR No.: 769002007/ SWIFT Code: SBININBB137

Please Note
- ✓ Incomplete registration-form (without proof/ details of online transaction) will not be considered.
- ✓ Registration fee is non-refundable.
- ✓ E-Certificate will be provided for the candidates attending all the sessions.
- ✓ There is no registration fee for the participants from the host institute.
- ✓ Online joining link(s) through *Google-meet/ MS-Team* will be shared in due course.
- ✓ **Last Date of Online Registration: May 31, 2025**

ADDRESS FOR CORRESPONDENCE

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ABOUT NIT Rourkela and ME DEPARTMENT

The erstwhile **Regional Engineering College (REC) Rourkela** was converted to a deemed university and renamed as **National Institute of Technology, Rourkela** on 26th June, 2002. It was declared as **An Institution of National Importance** through the parliament act on 15th August 2007. The institute has made a rapid stride in earning a reputation as a place of higher learning in the field of engineering as well as technology during the last decade. NIT Rourkela provides quality education in a diverse and multi-cultural environment. The mission of the institute is to meet the needs of the industry and commerce by providing human resource with the required knowledge and skill and also by promoting, dissemination, developing and transferring technology. The institute strives hard to become an internationally acclaimed institution of higher learning that will serve as a source of knowledge and expertise for the society and be a preferred destination for undergraduate as well as post graduate students along with advanced research.

The **Mechanical Engineering Department** of NIT, Rourkela is known for research in diverse fields. The main foci of research are on mechanical vibration, robotics, CAD/CAM, precision engineering, metal forming, Machining, CFD, Industrial refrigeration and Cryogenics. The academic programme of the department reflects not only the core areas of Mechanical Engineer but also the research specialization of the faculty. The department at present has over one hundred research scholars pursuing projects on diverse fields. The faculty is organized under three divisions and six groups. All the groups are working in close co-operation while retaining individual identities. Many Research and Development projects being pursued by the faculty are sponsored by Government agencies and private industries. Some of the major sponsors are BRNS, DST, DAE, CSIR, DRDO, BARC, ISRO and private industries.

OBJECTIVES of the WORKSHOP

In recent times, there is a considerable interest towards usage of additively fabricated parts/ products in high performance application domains. The guidelines for characterization, methodologies for performance testing and acceptance standards of conventionally manufactured parts are readily available. On the contrary, there is a lack of publicly available reliable data set in relation to additively manufactured material's properties and acceptance standards hence confidence levels in such parts are low. This creates a technical barrier to the widespread application of this amazing technology. Solving this problem is indeed challenging, since there exist numerous AM machine manufactures, the process involves a large number of control parameters, evolution of machine control software/ hardware versions and lack of documented standard measurement modules and test protocols of additively fabricated parts make it undoubtedly difficult and extremely expensive for industries to develop consensus materials property data into a reliable consolidated data base.

Presently, individual companies explore indigenous techniques or existing material standards (may not be AM-specific), not necessarily AM-suitable, in a case-by-case basis. Hence, it is the need of the present hour to derive effective characterization methods that can expand or replace conventional methods of materials characterization towards qualifying and quantifying unique attributes of additively fabricated products. This will definitely benefit to those industries sectors (aerospace, bio-medical and defense sectors) that consume highly intricate, customized metallic parts fabricated through additive route.

In this context, the proposed workshop is being planned to deliver an overview of additive manufacturing and aspects of materials characterization in line with sustainability goals. Materials characterization is a process of systematic measurement of a material's physical properties, chemical makeup and microstructure. Materials characterization is beneficial in driving new material innovations, guiding material selection, determining material properties for simulation, providing insight into failures (ill-performance), and defining application boundaries.

Sustainable manufacturing is to manufacture products through environmentally-sound processes by minimizing ill-environmental impacts while conserving energy and natural resources. The concept of sustainable manufacturing also encompasses employee, community and product safety. The six key aspects of manufacturing sustainability are environmental impact, energy usage, waste management, cost, resource utilization and occupational health and safety. Additive fabrication has the potential to minimize excess material consumption, to reduce environmental impacts and production costs. It adheres to the philosophy of greener and cleaner production methods across different industries enabling it a key technology for the future of sustainable manufacturing. It is to be kept in mind that a technology should not be used circumstantially or in *ad hoc* manner. It must be understood thoroughly including energy consumption. In line of the above, sustainable development aims to satisfy the needs of the present without compromising the ability of future generations to satisfy their own needs. Two broad aspects are intended to be addressed in this particular workshop – details of additive manufacturing technologies (*pros* and *cons*) and materials characterization with sustainability objectives.

The workshop AMMC-2025 is focused on effective knowledge transfer and networking of professionals involved in additive manufacturing technology domain. The course will include multiple interactive lectures sessions to be delivered by experts from premier institutions and professionals from Industries/ R&D organizations as well.

PROPOSED COURSE CONTENT

The workshop will cover but is not limited to the following topics:

Additive Manufacturing

Traditional manufacturing *versus* additive manufacturing; Different AM processes and relevant process physics, Application level: Direct processes – Rapid Prototyping, Rapid Tooling; Rapid Manufacturing; Indirect Processes - Indirect Prototyping, Indirect Tooling, Indirect Manufacturing; Industry 4.0

Discussion on different materials used; Use of multiple materials, multifunctional and graded materials in AM; Role of solidification rate; Evolution of non-equilibrium structure; Structure-property relationship; Grain morphology and microstructure, cooling rate and solidification, recrystallization, residual stress

Powder-based AM processes (selective laser melting, and electron beam melting); Printing processes - droplet based 3D printing; Solid-based AM processes - extrusion based fused filament fabrication object, wire based process- wire arc additive manufacturing; Liquid-based AM process- Stereolithography; Heat interaction phenomena; other AM processess- friction stir additive manufacturing; friction surfacing additive manufacturing; additive manufacturing of polymer composites

Aspects of Materials Characterization

Overview of materials characterization; The necessity and benefits of materials characterization; Examples of materials characterization (material composition, microstructure, physical properties, electrical properties, electronic reliability); Different methods for materials characterization - microscopy, spectroscopy, materials testing, etc.; destructive vs. non-destructive testing; materials characterization challenges; Corrosion and wear; Emphasis on characterization of powders and liquid materials that are relevant to additive manufacturing

Sustainable manufacturing

Concept of sustainability; manufacturing operations; resources in manufacturing; Concept of triple bottom line; environmental, economic and social dimensions of sustainability; Relation between green, lean and sustainable manufacturing; Environmental conscious; Life cycle analysis

Workshop

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Registration Form

NAME (Block Letter) _____

Designation _____ Department _____

Organization _____

Mail Address _____

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Mobile No (WhatsApp) _____ Email (Gmail) _____

PAYMENT DETAILS

Transaction Reference No _____ Date _____

Bank/ Branch _____

Bank Address _____

Amount Paid _____

Signature **Date**

Send the scan copy of the Registration Form (along with proof of online payment/ transaction details) through email to **Dr. Saurav Datta (sdatta@nitrkl.ac.in), Coordinator (MCSAM-2025), Department of Mechanical Engineering, NIT Rourkela-769008 (Odisha)**