



The Science of Making...



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TECHNICAL ACHIEVEMENTS

REFURBISHING 08X14H ALLOY CASTING WITH 03X12H ALLOY USING DED PROCESS

Since 2002, CMTI has developed significant expertise in metal-based additive manufacturing, specializing in two key process technologies: Direct Energy Deposition (DED) and Direct Metal Laser Sintering (DMLS). Our Additive Manufacturing Group has successfully collaborated with numerous customers in utilizing these processes to develop and refurbish high-value functional components across various applications.

Recently, our team achieved a major milestone by developing the DED process for repairing 08X14H alloy castings used in semi-cryogenic engines. We successfully established a sound metallurgical bond between 03X12H and 08X14H alloys, overcoming the challenge of achieving a crack-free interface—a result validated by Radiographic Testing (RT) and Dye Penetrant (DP) tests. This project underscores the critical role of optimizing process conditions in DED, along with the importance of designing specialized fixtures and maintaining optimal cooling to prevent distortion while ensuring robust metallurgical bonding at the interfaces.

CMTI is now leveraging its extensive knowledge of the DED process alongside its legacy expertise in ultra-precision machine development to engineer advanced DED-based additive manufacturing machines with larger build volumes. These machines will enable the production of full-sized functional parts, meeting the diverse needs of aerospace, defense, and space sectors. Notably, this will be the first large-scale additive manufacturing machine developed using domestically developed subsystems, marking a significant milestone in India's additive manufacturing capabilities.



DEMONSTRATION/ VISITS AT CMTI

»»» KEY ACTIVITIES AT THE SMART MANUFACTURING DEMO AND DEVELOPMENT CELL (SMDDC) - SEPTEMBER 2024

In September 2024, the SMDDC at CMTI hosted several significant visits. On the 19th, the HAL team toured the facility, where the Smart Manufacturing Cell (SMC) presented ongoing activities and showcased advanced smart manufacturing technologies. The same day, Prof. Sriram Venkatesh from Osmania University and Mr. Niranjana Reddy (JD, CMTI) visited, receiving comprehensive briefings on projects and exploring the integration of smart factory technologies for MSMEs.



On the 20th, 42 participants from the Aero Innovation and Skill Center (AISC) attended a technical presentation by Mr. Narendra Reddy T on smart manufacturing principles and Industry 4.0, followed by a detailed demonstration of SMC's initiatives. Additionally, students from AISC visited in two batches on the 13th and 20th for the VITB Experiential Learning 2024 event, where CMTI-SMC representatives participated as demo faculty. Furthermore, on the 20th, a training team from Applied Materials received hands-on training on PLC systems at the CMTI-HAL experimental learning labs. From 23-25, CMTI conducted Smart Manufacturing and Industry 4.0 training, attended by Applied Materials participants, with Mr. Prakash Vinod (JD & CH, C-SMPM) providing an overview of Industry 4.0 and the SMC showcasing advancements in smart manufacturing technologies.



RECOGNITION

Acknowledgment was received from the Aero Innovation and Skill Center (AISC) for the demonstration provided to students on the implementation of smart manufacturing practices, Industrial Internet of Things (IIoT), and Artificial Intelligence technologies.

TESTIMONIAL

"CMTI stands out as a global leader in precision manufacturing. It has significantly aided my Ph.D research and has enhanced India's manufacturing reputation in Japan."

-Masami Shimizu
Kyoto University, Japan

INDUSTRIAL VISIT TO CMTI

Industrial visit to CMTI labs and facilities on September 26, 2024 by PMCTECH, Hosur



EVENTS/CELEBRATIONS

»» CENTRAL MANUFACTURING TECHNOLOGY INSTITUTE (CMTI), BENGALURU CELEBRATES NATIONAL ENGINEER'S DAY WITH A TWO-DAY EVENT: "ADDITIVE MANUFACTURING RESEARCHER'S CONCLAVE" (SEPTEMBER 18-19, 2024)

Central Manufacturing Technology Institute (CMTI), Bengaluru, commemorated National Engineers Day on September 18-19, 2024, by hosting a two-day event titled the "Additive Manufacturing Researcher's Conclave." The event was a tribute to the engineering pioneers of India and was held in honor of the birth anniversary of Bharat Ratna Sir M. Visvesvaraya, one of the country's most renowned engineers and visionaries. National Engineers Day is celebrated across India to recognize the contributions of engineers in developing sustainable and innovative solutions to the world's most pressing challenges.

Keynote Speakers and Distinguished Guests:

The event was graced by esteemed personalities from the field of aeronautics and additive manufacturing. The Chief Guest, Shri Jitendra J. Jadhav, Director General of the Aeronautical Development Agency (ADA), Bangalore, delivered an insightful talk on the "Indian Aircraft Manufacturing Ecosystem." He elaborated on the importance of indigenous development and self-reliance in aerospace manufacturing, touching on key challenges and advancements in the Indian context. The Guest of Honour, Prof. K.P. Karunakaran, Professor at the Department of Mechanical Engineering, Indian Institute of Technology (IIT) Bombay, presented a keynote lecture titled "Indigenous Development of Electron Beam Hybrid Manufacturing." His presentation highlighted the critical developments in electron beam technology for additive manufacturing and its potential for revolutionizing industries, particularly in defense and aerospace sectors.



Expert Contributions and Key Technologies:

The conclave showcased presentations by around 25 leading Indian experts in additive manufacturing, as well as panel discussion by 5 prominent experts on the topic “AM technology adaption for Indian manufacturing - Dos and Don'ts” and seven PhD scholars who discussed advancements in Additive Manufacturing (AM) technologies that have achieved Technology Readiness Levels (TRL) 4 and 5. These presentations focused on various aspects of AM, with particular emphasis on AM machines developed in India and their industrial applications.

Key topics covered during the conclave included the use of laser-based additive manufacturing and refurbishment technologies across critical sectors such as defense, automotive, power, energy, aerospace, and biomedical. The event also explored emerging areas of AM, including applications in food production and electronics.

Prominent Keynote Lectures:

Some of the prominent keynote speakers and their topics included:

- Dr. C. P. Paul – Raja Ramanna Centre for Advanced Technology (RRCAT), Indore, “Indigenous Development of Laser Based Additive Manufacturing”.
- Prof. Ashish Kumar Nath – IIT Kharagpur, “Online monitoring and adaptive control in laser additive manufacturing for Microstructural characteristics”.
- Dr. I.A. Palani – IIT Indore, “A Novel Laser Decal Transfer based micro 3d printing Technology for printing MEMS devices”.
- Dr. K. R. Ravi – IIT Jodhpur, “The Journey in Developing Real-Time Monitoring and Closed-Loop Control for Direct Energy Deposition in Metal Additive Manufacturing”.
- Mr. H. Balaji – Aeronautical Development Agency (ADA), Bengaluru, “Future Perspective for Implementation of Metal Additive Manufacturing Technologies for Military Aircraft Programs”.
- Dr. S. M. Shariff – ARCI, Hyderabad, “Industrial Applications of laser-based additive manufacturing and refurbishment technologies for power, energy and defense sectors”.
- Dr. Aditya Kr. Lohar – CSIR-CMERI, Durgapur, “Challenges in using AM materials for Industrial applications”.
- Mr. Nagesha B.K. – Gas Turbine Research Establishment (GTRE), DRDO, Bengaluru, “AM technology way forward for aero engine applications”.
- Dr. Koushik Viswanathan – IISc Bengaluru, “Towards an AM system eco-system: From design specification to part realization”.
- Dr. Pradeep P I – VSSC, Thiruvananthapuram, “Metal Additive Manufacturing Technologies for Indian Space Program”.



Participation and Audience Engagement:

The event witnessed active participation from over 120 registered delegates, including professors, researchers, and scholars from renowned institutions such as MTRDC-DRDO Bengaluru, CSIR-CFTRI, IISc Bangalore, IIT Indore, IIT Tirupati, IIITDM Kancheepuram, NIT Surathkal, NIT Trichy, Anna University, Bharatiyar University, SRM Institute of Science and Technology, Jawaharlal Nehru New College of Engineering Shivamogga, KLE Technological University, Karunya Institute of Technology and Sciences, Vivekananda Institute of Technology Bangalore, Madanapalle institute of technology and Science and others.



In addition, key industry stakeholders were also represented, including Collins Aerospace, Applied Materials, 3D Graphy, AMpire 3D Solutions Pvt. Ltd, Francis Klein Aerospace Equipments, Lodestar Innovations Pvt Ltd, Intech Additive Solutions Pvt Ltd, Amace Solutions Pvt Ltd., kaushiks international, and others.

The event provided an excellent platform for industry-academia collaboration, fostering networking opportunities among experts, scholars, and industrial professionals. The Additive Manufacturing Researcher's Conclave at CMTI was a resounding success, bringing together leading minds in the field of additive manufacturing to share knowledge, discuss innovations, and explore the future of this rapidly advancing technology. The event not only highlighted the growing importance of indigenous AM technologies but also underscored India's commitment to achieving global leadership in advanced manufacturing.

HINDI PAKHWADA

The "Hindi Pakhwada" was successfully organized at CMTI from September 14-28, 2024, as part of promoting the use of Hindi in the day-to-day functioning of the institute. The celebrations culminated in the observance of "Hindi Diwas" on September 30, 2024. The event was graced by the presence of Dr. M. Sankara Prasad, retired DGM (Official Language) from Hindustan Aeronautics Limited, Bengaluru, as the Chief Guest. Dr. Nagahanumaiah, Director CMTI, presided over the function. During the event, prizes were awarded to the winners of various competitions, including Short Story Writing in Hindi, Memory Writing in Hindi, Noting & Drafting, What a Picture Speaks (for the wards of CMTI employees up to 12th standard), and a Technical Seminar in Hindi.



EVENTS/ WORKSHOPS ATTENDED

Karanam Manjunath, Scientist B at C-MNTM, participated in the S.V. Narasaiah Memorial Lecture organized by the Department of Instrumentation and Applied Physics (IAP) at IISc and Hind High Vacuum Company Pvt. Ltd. on September 28, 2024. The lecture, titled "Synergizing Academic Research and Innovation for Product Development: A Blueprint for AtmaNirbhar Bharat," was delivered by Prof. V. Rama Gopal, Group Vice Chancellor of the BITS Group.

EVENTS/ WORKSHOPS CONDUCTED

The CMTI Regional Centre in Rajkot, in collaboration with NABL, successfully conducted an "Awareness Program on NABL Accreditation" on September 26, 2024. The event drew an enthusiastic participation of 70 to 75 representatives from both industry and academia.



TRAINING INITIATIVES

TRAINING PROGRAMME ON "ADVANCED MATERIAL CHARACTERIZATION TECHNIQUES"

From September 23-26, 2024, a training program on "Advanced Material Characterization Techniques" brought together nine participants from Collins Aerospace, BrahMos Aerospace, CQAS, and QEA, coordinated by Mr. Sarmista Dhan. The program included hands-on demonstrations of techniques like ellipsometry, confocal microscopy, and X-Ray Diffraction (XRD), concluding with a certificate distribution ceremony that highlighted the success of this knowledge-sharing initiative.



MECHATRONICS & MANUFACTURING AUTOMATION INDUSTRY 4.0 & SMART MANUFACTURING SYSTEM (ELECTRICAL NCG)



From September 16-25, 2024, a training program on "Mechatronics & Manufacturing Automation: Industry 4.0 & Smart Manufacturing System" was conducted for five participants from Applied Materials India Pvt. Ltd., coordinated by Mr. Anil Kumar and Mr. Narendra Reddy T. The comprehensive curriculum included manufacturing automation, sensors, predictive maintenance, and digital twin concepts, culminating in visits to CMTI labs and a certificate distribution ceremony.

▶▶▶ TRAINING PROGRAMME ON “GD&T, MANUFACTURING & INSPECTION (MECHANICAL NCG)”

A training program on "GD&T, Manufacturing & Inspection (Mechanical NCG)" was conducted from September 16-27, 2024, for 19 participants from Applied Materials India Pvt. Ltd., coordinated by Mr. Anil Kumar K. The curriculum included dimensional metrology, GD&T demonstrations, and non-traditional machining methods, enhanced by industrial visits to Harshitha Sparktech and Plating Superchem Finishers, concluding with a certificate distribution ceremony.



▶▶▶ TRAINING PROGRAMME ON “NOISE & VIBRATION ANALYSIS METHOD (BASIC & ADVANCED)”



A training program on "Noise & Vibration Analysis Methods (Basic & Advanced)" took place from September 23-26, 2024, for 12 participants from various organizations, coordinated by Mr. Girish Kumar M. The curriculum included fundamental concepts of mechanical systems, instrumentation techniques, and advanced topics such as noise and vibration analysis and dynamic balancing, supplemented by practical demonstrations to enhance participants' understanding.

▶▶▶ TRAINING PROGRAMME ON “BASIC COURSE ON SINGLE POINT DIAMOND TRAINING (SPDT)”

A training program on "Basic Course on Single Point Diamond Turning (SPDT)" was conducted on September 26-27, 2024, for 11 participants from organizations like BDL Hyderabad and ACE Designers Ltd., coordinated by Mr. Gopi Krishna S. The course introduced SPDT, covering its applications, machine technology, and tool setting processes, complemented by practical demonstrations to enhance participants' proficiency in this advanced manufacturing technique.



CONTRIBUTORY TALKS

Dr. Debeshi Dutta, Scientist 'C' at C-MNTM, delivered a lecture on "Applications of IoT and ML in Animal Health Management" on September 17, 2024, during a training program titled "Digital Agriculture: Use of IoT, Innovative, and Hi-Tech Agriculture," organized by ICAR-Indian Institute of Horticultural Research in Bengaluru. The training program was attended by 30 officers from the National Bank for Agricultural and Rural Development (NABARD), facilitated through the National Bank Staff College (NBSC), Lucknow.

Mr. K. Niranjan Reddy (JD, CMTI), delivered a guest lecture on September 20, 2024, titled "Introduction to Micro and Nano Machining and Characterization Techniques," as part of the training course on "Sub-Terahertz Technologies," organized by the Microwave Tube R&D Centre (MTRDC), DRDO, Bangalore.

PUBLICATIONS

Neha Khatri, K. Manjunath, Suman Tewary, Wenjun Kang, and Rongguang Liang "Measurement of mid-spatial frequencies of diamond turned optics by using dual-mode snapshot interferometry", Proc. SPIE 13134, Optical Manufacturing and Testing 2024, 131340I (September 30, 2024); <https://doi.org/10.1117/12.3027730>

UPCOMING TRAINING PROGRAMMES

- "Packaging & Characterization of MEMS & IC Devices", Course Code: 0740, from November 4-6, 2024, at CMTI, Bangalore.
- "Estimation of Measurement Uncertainty by MCS", Course Code: 0940, from November 11-12, 2024, at CMTI, Bangalore.
- "Advanced Materials Characterization Techniques", Course Code: 0390, from November 18-21, 2024, at CMTI, Bangalore.
- "Gear Engineering", Course Code: 0620, from November 19-20, 2024, at CMTI, Bangalore.
- "Introduction to CMM", Course Code: 0430, from November 20-22, 2024, at CMTI, Bangalore.
- "Laboratory Management & Internal Audit as per ISO / IEC 17025:2017", Course Code: 0410, from November 25-28, 2024, at CMTI, Bangalore.

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for more details

Exciting updates are on the way—stay tuned for our next issue!...

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