Under the aegis of GIAN Advanced Course on

Manufacturing and Processing of Advanced Metallic, Ceramic and Composite Materials

10th to 14th August, 2020

GLOBAL INITIATIVE OF ACADEMIC NETWORKS

सत्यमेव जयते

Sponsored by: MHRD, Govt. of India

Organized By

Department of Mechanical Engineering,
MNIT, Jaipur (Rajasthan)

Jawahar Lal Nehru Marg, Malaviya Nagar, Jaipur, Rajasthan -302017,
Website: www.mnit.ac.in

Overview

This course will provide a comprehensive overview of materials manufacturing processes from the vantage point of elevated-temperature interactions among materials that manifest themselves in a wide variety of physical phenomena, and material properties and performance. Robust manufacturing technology demands scientific understanding of the metallurgical and materials mechanisms and processes underlying such interactions. The first one-third of the course content will provide solid foundational knowledge about diverse liquid-state, solid-state and vapor-state manufacturing processes. The remainder of the course will comprehensively cover high-temperature interactions, interface formation, and application to metal-matrix and ceramic-matrix composites, melting technology, refractory design, melt oxidation, liquid metal corrosion, solidification, crystal purification, infiltration, soldering, brazing, coating, sintering, and emerging 3D printing and other advanced processes. Material interactions at high temperatures are sensitive to a myriad of material and test parameters such as contact time, temperature, alloying, roughness, composition, coatings, atmosphere and crystal orientation among others. Conversely, such interactions could be used as a sensitive probe to investigate the material properties and behavior at elevated temperatures.

The course will cover the thermodynamics and kinetics of physical and chemical interactions among materials at elevated temperatures including spreading and capillary flow, starting with the classical description of surface energies, contact angle, work of adhesion, and interface bonding in non-reactive systems and moving to the more complex reactive spreading controlled by real-time chemical interactions involving dissolution, oxidation, wetting, reaction, diffusion, segregation and thermal and mass transport processes that control flow, spreading and interface formation. Case studies on contact angle and interfaces in oxides, carbon, carbides, borides, nitrides, silicides, and glass will be presented. Theoretical principles, processing technology and selected applications of brazed or diffusion bonded advanced ceramic, metallic and composite joints will be discussed. The role of thermo-elastic incompatibility and residual stresses on joint integrity, reliability and functionality will be discussed with the aid of latest real-world examples of structural, functional, and thermal management applications. Advanced joining concepts and technology developed over the last decade at NASA to join new and emerging ceramics and composites to high-temperature alloys will be described. Stress mitigation strategies using compliant interlayers of graded expansion and modulus shall be highlighted. Active learning based on problem-solving approach shall be implemented to provide each participant with the knowledge and skills needed to identify problems and generate viable solutions to mitigate manufacturing and processing problems.

Objectives of the course	1. Understand the engineering science behind solidification processing, metal casting, powder-based manufacturing, surface engineering, coating, and joining and integration processes 2. Identify and describe appropriate manufacturing processes for manufacturing parts, diagnose processing problems and explain the corrective action required to improve the process 3. Analyze process mechanics of powder manufacture, powder compaction and sintering 4. Discuss the thermodynamics and kinetics of interactions among materials including contact angles, wetting and adhesion and understand the role they play in diverse materials processing and manufacturing technologies 5. Demonstrate knowledge and understanding of the principles and technology of joining and integration as applied to advanced materials in critical technology applications.
Course duration	▶ Duration: 10th to 14th August, 2020 ▶ Total Contact Hours: 29 hours: 2 hour lectures/day, 4 tutorials, over one week ▶ Number of participants for the course will be limited to fifty
Course contents	▶ manufacturing and materials science, solid-state and vapor-state manufacturing ▶ casting design, Powder-based manufacturing, Surface engineering ▶ Capillarity - concepts, Reactive wetting, Contact angle measurement ▶ Interfacial phenomena in processing and manufacturing I and II
Who should attend the course	Research students, upper-level undergraduate students, early-career faculty, scientists, and practicing engineers and technologists inindustry, universities, and R&D establishments whose profesional interests or job demands design, synthesis, processing, and manufacturing within automotive, energy, aerospace, nuclear, defense and a wide variety of other critical technology sectors
Course Registration Process	**Step 1: One Time Registration** Registration for GIAN courses is not free because of constraint in the maximum number of participants allowed to register for a course. In order to register for any course under GIAN, candidate will have to get registered one time first to GIAN Portal of IIT Kharagpur using the following steps: 1. Create login and password at http://www.gian.iitkgp.ac.in/GREGN/index 2. Login and complete the Registration Form. 3. Select Courses 4. Confirm your application and payment information. 5. Pay Rs. 500/- (non-refundable) through online payment gateway. 6. Download and print "pdf file" of your enrolment application form for your personal records and copy of the same to be sent to the Course Coordinator. **Step 2: Institute Registration** Institute registration process is an offline process. Interested candidates are requested to download the Registration Form (docx/pdf).
Course Fees	The participation fees for taking the course is as follows: ● Participants from abroad: US$100 ● Industry/Research Organizations: Rs. 5000 /- ● Faculty from Indian academic Institutions: Rs.2500 /- ● Research Scholars and students: Rs.1000/- Note: ● The above fee includes all instructional materials, computer use for tutorials and assignments.(Exclusive of GIAN Portal Registration fee) ● The participants will be provided accommodation on payment basis. ● Please note that no TA/DA shall be paid to participants.
Registration date and Mode of fee payment	The Registration fee has to be paid via **Demand Draft/NEFT**, in favour of "**Registrar, MNIT Jaipur**" payable at Jaipur. Payment can also be done through **National Electronic Funds Transfer (NEFT)** to the account of "Registrar, MNIT Jaipur" (Account No.:676801700388 ICICI Bank, Branch MNIT Jaipur, IFSC Code: ICIC0006768. Hard copy of the registration form, by **Courier/ Speed Post/ Registered Post** before **30th June, 2020** to: **Dr. Amar Patnaik, Associate Professor, Department of Mechanical Engineering, J.L.N. Marg, MNIT, Jaipur-302017, Rajasthan, India.** Please email a scanned copy of the DD/NEFT and duly filled signed registration form to **Dr. Amar Patnaik** at **apatnaik.mech@mnit.ac.in**
Local accommodation	Accommodation at the Institute Guest houses will be available on payment basis. The details regarding boarding and lodging are as follows: ***Guest House 1 (Limited capacity):***Twin Sharing basis, Excluding Food Charges: Rs. 900/- per day + Taxes ***Guest House 2:*** Twin Sharing basis, Excluding Food Charges: Rs.700/- per day + Taxes ***Aurobindo Boys Hostel:*** Twin Sharing basis, Excluding Food Charges: Rs.200/- per day ***Gargi Girls Hostel:*** Twin Sharing basis, Excluding Food Charges Rs.200/- per day There are many good fair price lodging facilities available nearby the campus. TA/DA will not be paid to any participant.

International Expert:

Prof. Rajiv Asthana

Dr. Rajiv Asthana is a professor in the Robert F. Cervenka School of Engineering at the University of Wisconsin-Stout, USA, where he has taught 14 different courses in a lecture and laboratory environment for the last 22 years, developed new courses and curricula, and developed and managed laboratories in metal casting, metallurgy, and ceramic processing and testing. His professional experience also includes eight years with NASA as a consultant, guest researcher, and, early in his career, as a post-doctoral research associate. Dr. Asthana's materials research has focused on joining of ceramics, CMCs and advanced alloys; solidification and interface strength in advanced aerospace composites; and high-temperature capillary and interfacial phenomena.

Dr. Asthana has authored or coauthored nearly 200 journal and conference publications, and book chapters in the above areas, and five books including *Materials Science in Manufacturing* (Elsevier), *Engineering Materials & Processes Desk Reference* (Elsevier), and *Solidification Processing of Reinforced Metals* (Trans Tech). He has been an Editor of *Springer Materials*; Editor of *Journal of Materials Engineering & Performance*; co-editor,(Book) *Ceramic Integration & Joining Technologies* (Wiley); co-editor, (Book) *Green and Sustainable Manufacturing of Advanced Materials* (Elsevier); and a guest editor of special issues of four materials science and engineering journals published by Elsevier and Springer. He has presented 80 guest lectures in Poland, Italy, Germany, India, USA, Canada, China, Japan, Czech Republic and UK, and served as a grant reviewer / panelist for U.S. National Science Foundation, U.S. Department of Energy, and the U.S. Army among others. He also serves on various professional society committees, journal editorial boards, and organizing and advisory boards of international conferences.

Dr. Asthana was the inaugural Fulton Holt by Endowed Chair at University of Wisconsin-Stout. He has been a visiting professor / visiting scholar at University to Wisconsin-Milwaukee (USA) and Foundry Research Institute (Poland) and, early in his career, he was a scientist with Advanced Materials & Processes Research Institute (AMPRI) of CSIR at Bhopal. He is an elected Fellow of American Society for Materials and a recipient of the Distinguished Engineering Educator Award of The Engineers' Council (USA), Albert Nelson Marquis. Lifetime Achievement Award, Dean's Outstanding Alumni Award from University of Wisconsin-Milwaukee, and a NASA award for technical innovation. He earned his B. Tech (Hons.) and M. Tech. degrees from IIT Kharagpur and his doctorate in materials engineering from University of Wisconsin-Milwaukee.

Course Coordinators:

Dr. Amar Patnaik
Associate Professor , MNIT Jaipur

Prof. M.K.Banerjee
Ex-Professor, MNIT Jaipur

Prof. G.S. Dangayach
Professor, MNIT Jaipur

Dr. Gunjan Soni
Assistant Professor, MNIT Jaipur

Dr. Amit Kumar Singh
Assistant Professor, MNIT Jaipur

Dr. Dinesh Kumar
Associate Professor, MNIT Jaipur

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Registration form

Name (In Block Letters):…….

Designation:.....

Qualification: .....

Institution:.....

Address:

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Email address:…… ...

Mobile No:……

Details of Demand Draft:

DD No/ Transaction ID : ..... Bank Name:.....

Date: ..... ……. Amount Rs: .....

Signature of the Candidate

****Speed Post latest by 30th June, 2020 and send scanned copy of the same on**
apatnaik.mech@mnit.ac.in

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