Hybrid Additive Manufacturing Viewed from Materials Science: Fundamentals and State of the Art

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Overview

Manufacturing sector is undergoing significant changes in ways the product is designed, fabricated and ultimately transferred to consumer. Additive Manufacturing (AM) is a visionary approach to flexible-cell manufacturing applied to components often selected for their difficult-to-make shapes, including intricate passageways. Like welding, AM relies on a layer-by-layer deposition of fused-metal feed-stock. AM and welding involve an energy source (e.g., Laser, Electron beam, Electric Arc, or Plasma), one or several feedstock (e.g., powder, wire, and ribbon), and spatial displacement, as provided by a CNC stage or a multi-axis robot. From materials and metallurgical standpoints, **welding and additive manufacturing,** bring into play: (1) a multitude of complex and interacting physical phenomena such as heat and mass transfer, continuum mechanics, phase changes (including melting, solidification, allotropic transformations and diffusion phenomena such as epitaxial growth, grain growth and crystal orientation), (2) a number of process variables associated to the moving heat source (e.g., its power, power distribution, relative speed, size, all affecting energy density), its paths (e.g., linear, circular, oscillatory, etc), and added metal feed rate via powder, wire, or ribbon feed, all controlling deposit dimensions, aspect-ratio, and deposit properties, including internal defects. The effect of successive thermal cycles, as induced by the heat source moving away from an already deposited material, further adds to the overall challenge of developing industry-compliant components with sufficient physical, mechanical, electrochemical properties and proper dimensional controls**. The theory and practice of advanced welding and additive manufacturing will constitute the core of the course**

Learning Outcomes

At the conclusion of this course, the participants are expected to:

1. Understand the material basics that govern manufacturing potentials
2. Identify the various options available to do additive manufacturing process from available welding sources.
3. Apply simulation techniques to model and analyze the material behavior during the process.

Modules	A: Understanding Material basics that govern manufacturing potentials : April 3, 2018 B: High Energy density Processes; Laser, Electron Processes : April 4, 2018 C: Technology and materials :Powder Bed, Direct Energy deposition Processes : April 5, 2018 D: Sintering Mechanism: A Comparison of P/M and Laser Sintering in AM : April 6, 2018 E: Post Processing techniques for additive manufactured components : April 7, 2018 Number of participants for the course will be limited to Fifty (50) **The last date to apply for the course is ~~March 15, 2018~~ March 31, 2018(Saturday)**
You Should Attend If…	Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories. Students at all levels (B.Tech/MSc/M.Tech/Ph.D) or Faculty from reputed academic and technical institutions.
Fees	**For Students from India:** Participation without grading: Rs. 500/- Participation with grading : Rs. 1000/- **For Faculty/Scientists/Industry from India:** Faculty (Internal & External) & Scientists from R&D Labs: Rs. 2000/- Persons working in Industry / Consultancy firms : Rs. 4000/- **For Participants from abroad** Students : USD 50 Faculty/Scientists/Persons from Industry & Consultancy firms : USD 100 The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

1. Prof S Marya, Ecole Centrale Nantes, France, Foreign Faculty)

Emeritus Professor at Ecole Centrale Nantes and independent consultant in materials and manufacturing, Prof Marya has established experience in a variety of fields related to metallic materials and resolving industrial cases of manufacturing. His expertise is resumed as follows /Physical Metallurgy (Titanium alloys, Aluminium Alloys, Ferrous Alloys, etc) Advanced Materials and Manufacturing Processes (Fusion and Solid-State Joining, Machining and Cutting, Superplastic Forming, LASER and Plasma Processes, Laser Arc hybrid Welding of line pipes, Friction Stir Welding of Steels, Linear Friction welding, Laser assisted FSW, Electro-magnetic Pulse Forming and Welding – New, Electro hydraulic forming – Additive manufacturing Consulting In materials & manufacturing technologies. Laser Arc Hybrid of line pipes, Rolled Welded Tube manufacturing, Friction Stir Welding of Steels, High penetration TIG Welding (infocus, ATIG, K Tig..) Survey of R&D projects and coherence with Home industry requirements, Lobbying; Technology transfer etc

2. Dr. M J Davidson, Department of Mechanical Engineering, NIT, Warangal, India (Host Faculty)

3. Dr. Kanmani Subbu, Department of Mechanical Engineering, NIT, Warangal, India (Host Faculty)

Steps for Registration

(i) Prospective participants have to register first on GIAN Portal (http://www.gian.iitkgp.ac.in/GREGN/index) by paying Rs. 500 /- (One time non-refundable GIAN Portal registration fee).

(ii) Then select the course from the list of courses available in the portal. Register for the course selected. Pay the Course fee as per the following details-

Account Name	GIAN NITW
Account No	62447453600
Branch	SBI, NIT Branch, Hanmakonda, Warangal.
IFSC code	SBIN 0020149

For those who need **food and accommodation** in campus during the course, the extra amount to be paid is **Rs 3500/-** . This amount includes accommodation (On shared basis in the Institute Visitors Block and nearby guest houses) for five days and breakfast, lunch and dinner for five days.

Course Co-ordinators

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