

Microstructural Evolution during Friction Stir Processing

Overview

Friction stir processing (FSP) is a solid state material processing technology where the microstructure of material can be altered without melting. Severe plastic deformation during FSP results in generation of a recrystallized fine-grained microstructure within stirred zone. The process can be applied to various applications such as grain refinement, superplasticity, casting modification, low temperature deformability, surface alloying and surface composites, etc. Understanding of the microstructural evolution during FSP due to effect of both thermal energy and deformation is of great importance to develop alloy properties of certain liking. The course will cover the basics of microstructural evolution during FSP, including ultra-fine grained structures, precipitate dissolution, homogenization, dynamic recrystallization etc. The course will compare microstructural evolution in primary engineering alloys, like, steels, aluminum alloys, titanium alloys, magnesium alloys, and alloys that cannot be traditionally processed, like immiscible copper alloys.

The primary objectives of the course are as follows:

- i) Introduction to fundamentals of Friction Stir Processing of materials
- ii) Understanding of microstructural evolution during FSP of primary engineering alloys such as steels, aluminium alloys, magnesium alloys, titanium alloys
- iii) Development of ultra-fine grained materials and understanding of enhanced precipitate dissolution using FSP
- iv) Comparison of microstructure evolution during FSP of alloys difficult to process such as immiscible copper alloys
- v) Unique microstructural evolution in new high entropy alloys
- vi) Surface processing and casting modification using FSP

<h2>Modules</h2>	<ul style="list-style-type: none"> • Introduction to FSP and process parameters • Fundamentals of process, heat generation and material deformation • Grain refinement during FSP • Microstructure evolution in FSP of aluminum alloys • Steels and Titanium alloys • Immiscible Copper alloys • Precipitate dissolution kinetics • Ultra-fine grained materials and superplasticity • High entropy alloys • Applications for surface processing and casting modification <p>Dates: 7-12 Oct, 2019. Venue: IIT Gandhinagar Deadline for registration: 25 September 2019 Limited number of seats are available for the workshop.</p>
<h2>You should attend if...</h2>	<ul style="list-style-type: none"> ▪ You are student (BTech/MTech/PhD) or faculty member from Materials Science/Metallurgy/Mechanical/Production Engineering. ▪ You are executive, engineer or researcher from manufacturing, service and government organizations including R&D laboratories.
<h2>Fees and Registration</h2>	<p>The participation fees for the course is as follows:</p> <p>Participants from abroad : US \$250 From SAARC: US\$150 Industry: Rs. 16,000/- Research Organizations: Rs. 8000/- Faculty/Academic Institutions: Rs. 5000/- Student : 1500/-</p> <p>The above fees include all instructional materials, computer use for tutorials and internet facility at the host institute during the course. The participants will have to take care of their travel. Accommodation can be arranged for participants on first-cum-first-serve basis for nominal payment. For any queries regarding registration or other practical information, please contact the course coordinator.</p> <p>Participants can register for the course on the link below:</p> <p>Find more information at : http://events.iitgn.ac.in/2019/fswp/</p>

The Faculty

Dr. Rajiv S. Mishra (Ph.D. in Metallurgy from University of Sheffield) is a University Distinguished Research Professor at University of North Texas. He serves as the Director of a recently launched Advanced Materials and Manufacturing Processes Institute (AMMPI) at UNT. He is also the UNT Site Director of the NSF I/UCRC for Friction Stir Processing and a Fellow of ASM International. He is a past-chair of the Structural Materials Division of TMS and served on the TMS Board of Directors (2013-16). Dr. Mishra has many 'firsts' in the field of friction stir welding and processing. He co-authored the first review paper (2005), co-edited the first book on the subject (2007), edited/co-edited seven TMS symposium proceedings, and served as guest editor for Viewpoint Set in Scripta Materialia (2008). He also has three patents in this field. He published the first paper on friction stir processing (2000) as a microstructural modification tool.



Dr. Amit Arora is Assistant Professor of Materials Science and Engineering at IIT Gandhinagar. Dr. Arora is B. Tech. and M. Tech. (Dual Degree) in Metallurgical and Materials Engineering from IIT Kharagpur. He received Ph.D. in Materials Science and Engineering from The Pennsylvania State University in August 2011. Dr. heads the Advanced Materials Processing Research Group at IIT Gandhinagar and his research interest is physical understanding of the joining processes, heat transfer and material flow modeling, and friction stir based processing of materials.

Course Co-ordinator

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