सत्यमेव जयते
Ministry of Education
Government of India

GLOBAL INITIATIVE OF ACADEMIC NETWORKS

SVNIT SURAT

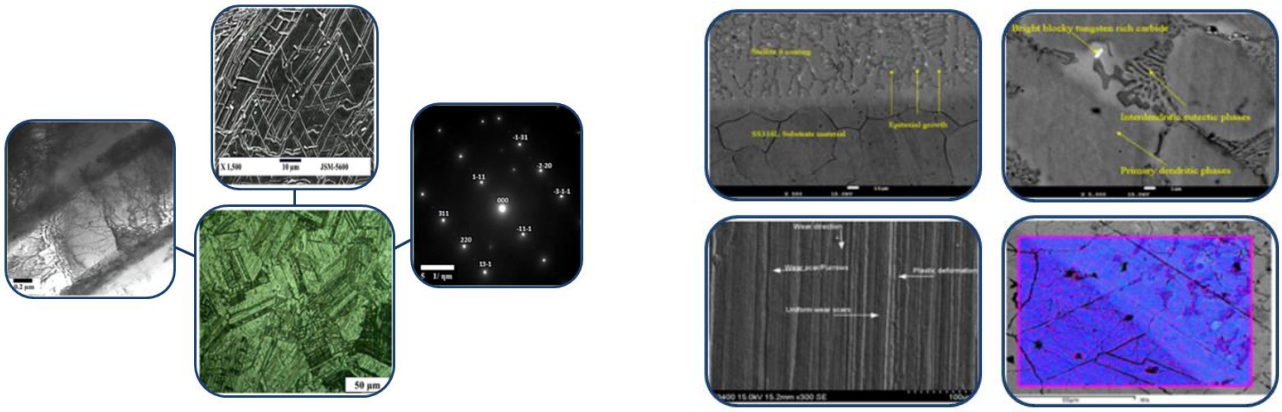
Microstructural control and advanced metallurgical characterization: Application to thermomechanical processing, welding and severe plastic deformation (Course code: 191033L03)

(30 January – 03 February 2023)

Overview

Metallurgical science contains disparate time and length scales spanning years to femtoseconds and meters to angstroms in accordance with research investigations and problem of interest. It is well known that characteristic length (in terms of distance but also of time) governs most of the metallurgical phenomena. Particularly, the microstructure control of the materials has strong influence on fundamental mechanical properties such as toughness, strength, hardness, ductility, corrosion resistance, wear resistance, etc. which are useful in structural applications. On the other hand, grain refinement, grain structure during solidification, inhomogeneities and phase transformations (where time scale plays a major role) are significant metallurgical aspects affecting mechanical properties in welding applications. It is important to analyze microstructure/nanostructure by advanced characterization techniques like SEM, EDS, XRD, TEM and EBSD in order to understand properly the correlation between properties and ultrafine microestructures. Hence, it is essential to enhance research potential by providing insightful view by field experts to the research community in accordance with proposed course.

The aim of this course is to provide fundamental understandings of various microstructure controlling mechanisms in metals for structural applications. Emphasis is given on promoting grain refinement up to ultrafine and nanometric grain sizes by a) thermomechanical processing, b) microstructural changes during welding, and c) severe plastic deformation processes, aiming to improve properties of interest for structural applications. In this sense, metallurgy and solidification of the weldments are important aspects to understand the science behind weldments.



Few glimpses of microstructural features obtained through SEM, TEM, OM and EDS

Theoretical conceptualization will be beneficial in grasping the basic understanding of microstructural characterisation techniques. Faculties, research scholars and industrial persons will be able to understand and apply it to their respective research areas. Outcomes in terms of basic learnings about material characterization techniques will be applicable to material development and materials' processing to solve current industrial challenges.

Objectives:

The primary objectives of the course are as follows:

i) Exposing participants to the need and significance of microstructure control in structural applications.

ii) Building in confidence and capability amongst the participants for grain refinement in regard to mechanical properties for ultrafine and nanometric grain sizes.

iii) Providing exposure to different thermomechanical processing in terms of grain refinement by dynamic recrystallization, plus modelling, simulation and testing.

iv) Enhancing the capability of the participants to summarize fundamentals on grain structure, inhomogeneities and phase transformation to welding applications.

v) Providing exposure to severe plastic deformation processes with their applications including future trends.

vi) Providing exposure to classical and advanced characterization techniques for observing microstructural alterations.

Course information	**Duration: 30 January – 03 February 2023** **Total contact hours:** Minimum 20 (Including lectures and hands-on) **The number of participants for the course will be limited to 50.**
Modules	▪ Significance and need of metallurgical considerations in structural applications. ▪ Importance of grain refinement in regard to mechanical properties. ▪ Overview of microstructural control in structural applications. ▪ Hall-Petch inversion, mechanical properties for ultrafine/nanometric grain sizes. ▪ Thermomechanical processing: Dynamic recrystallization; modelling and simulation; testing. ▪ Welding metallurgy: Grain structure in weld pool during solidification - Growth, control and microstructure refinement; welding inhomogeneities and microstructural studies of welding defects; phase transformation theory to welding - Introduction and applications. ▪ Severe plastic deformation processes: Equal channel angular pressure and high pressure torsion, other processes, application to welding (friction stir welding), future trends. ▪ Interpretation of micrographs and industrial case studies related to metallurgical characterization. ▪ Mechanical behavior of metals with nanometric grain sizes. ▪ Future trends for research and opportunities in material science/welding applications
You should attend if…	▪ You are designer, manager, executive, engineer, technician, researcher, scientist, etc. from industries, government organizations including R&D laboratories. ▪ You are faculty from reputed technical institutions. ▪ You are PG student and research scholar, etc.
Course fee	▪ **Industry/Govt./Research organizations:** Rs. 3,500/- ▪ **Faculty/staff from academic institutions:** Rs. 3,500/- ▪ **Research scholar/Student:** Rs. 2,500/- **Additional 18% GST as per Govt. of India norms is applicable on the course fee.** The course fee covers the course materials, access to all the sessions, tutorials, laboratory usage, and refreshments/working lunch between the course sessions. The interested participants will be provided single/shared accommodation in the Institute guest house/student hostel on self-payment basis, subjected to availability.

The Faculty

- **Dr. Jose Maria Cabrera Marrero**, born at Santa Cruz de Tenerife, Canary Islands, Spain in 1964.
  He has been a **Professor** of Metallurgy at the Polytechnic University of Catalonia (UPC), Spain since 1996 and is currently a **University Professor ("Chair")** in the **Department of Materials Science and Engineering** of the UPC, a position he has held since 2008.
  He was secretary of the department for 10 years, and **deputy vice director** of the same and responsible for the doctoral program for another 10 years. He is currently **Director** of the **CIM UPC Foundation**.
- He has been the recipient of a **research training grant** (1992-1995) and a postdoctoral fellowship (1995-1996) from the **Generalitat de Catalunya**.
- He has carried out research stays at various universities like, **McGill University** Montreal, **National Polytechnic Institute of Mexico City** (1995 and 1996, where he obtained an appointment as a visiting professor), **Federal University of Sao Carlos** Brazil (2012), **Materials Research Institute of the UNAM** Mexico (2017).
- He has made a sabbatical stay at the **Institute of Research in Materials and Metallurgy** of the **Michoacan University of San Nicolas de Hidalgo**, Morelia for 12 months (September 2019-August 2020), financed by CONACyT.
- He has participated in more than **70 research projects** (leading 50) both competitive public funding (responsible for four CICYT projects, a PETRI, an ALFA network, member of a CYTED project, leader of three European RCFS projects and participant in two others), and in projects with companies (including two large projects funded by the CENIT program).
- His area of knowledge is oriented to the **characterization of the plastic behavior, mainly at high temperature, of metallic materials**. It is basically in this area that Professor Cabrera has made his greatest contributions, especially by offering a **universal constitutive equation** that explains the **hot creep curves of practically all types of metallic materials.**
- He has given lectures, talks and courses at universities, institutes and industries in **France**, **England**, **Germany**, **Belgium**, **Greece**, **Russia**, **Mexico**, **Argentina**, **Colombia**, **Chile**, **Venezuela** and **Brazil**.
- He has published more than **250** scientific papers and presented more than **400** communications in conferences, congresses, plenary talks.
- He has also supervised **17 PhD** students.
- For more details visit: https://orcid.org/0000-0001-8417-1736 Scopus Author ID: 35271381300

Dr. Vivek Kalyankar is presently serving as Assistant Professor in the Department of Mechanical Engineering at S. V. National Institute of Technology (SVNIT), Surat, Gujarat, India, which is an Institution of National Importance of Govt. of India. He is having around 20 years of professional experience which involves the blend of academics, research, and industry experience. His research interest mainly includes the **weldability of advanced grades of materials** and **surface engineering** with high temperature applications.
He was instrumental in developing an advanced welding laboratory in the department which consists of state of the art research facilities highlighted with the availabilty of plasma transferred arc welding set up, Servo-electro mechanical creep testing machine set up, etc. Apart from handling several funded projects, he developed good networks with surrounding **industries** of the field and involved in attempting various **industry-based projects** through research on their ongoing materials. He is a co-author of more that 35 International articles and also acting as a reviewer to various reputed International Journals. He is a **recipient of the 'Young Engineer Award in Mechanical Engineering Discipline' in 2014-2015** given by Institution of Engineers (India). For more details visit: https://orcid.org/0000-0002-7141-3705 Scopus Author ID: 55279804400

Course coordinator:

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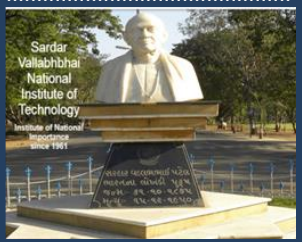

Registration process

Step 1: One Time Web (Portal) Registration

The candidates are advised to visit GIAN Website using the link: https://gian.iitkgp.ac.in/GREGN/index and create Login User ID and Password. Fill up the blank registration form and do web registration by paying Rs. 500 online through Net Banking/Debit/Credit Card. This provides the candidate with life-time registration of the GIAN portal to enroll in any number of the GIAN courses offered. **Those candidates, who have already enrolled at the GIAN portal, need not register again.**

Step 2: Course Registration (Through GIAN Portal)

Log in to the GIAN portal with the user ID and Password created. Click on "Course Registration" option given at the top of the registration form. Select the Course titled **'Microstructural control and advanced metallurgical characterization: Application to thermomechanical processing, welding and severe plastic deformation' (Course code: 191033L03)** from the list and click on 'Save' option. Confirm your registration by Clicking on 'Confirm Course'

Step 3: Course fee payment

After registration on GIAN portal, the course fee is to be paid online in the account of SVNIT Surat, the details of which are given below:

Course Fee

- Industry/Govt./Research organizations: Rs. 3,500 (+ 18% GST)
- Faculty/staff from academic institutions: Rs. 3,500 (+ 18% GST)
- Research scholar/Student: Rs. 2,500 (+ 18% GST)

Account Details

Bank: State Bank of India
Name: Director, SVNIT-CCE
Account Number: 37030749143
IFSC Code: SBIN0003320
MCIR Code: 395002012

Scan code:

The participants should pay registration fee through online mode (NEFT/IMPS/SCAN & PAY) and fill in the transaction ID/details in the Google Form using the link given in Step-4.

Step-4:

After online payment of course fee, fill the google form Registration link given below: https://forms.gle/XuKLwTxZU8CDGc92A
You will receive the final confirmation of participants from the course coordinator after few days of completion of all steps.