ASM INTERNATIONAL

Bangalore Chapter – News Letter

Issue 9 - July 2022

Contents

Chairperson's Message

Dear Readers,

I am reminded of Swami Vivekananda, who said "The world is a great Gymnasium, where we come to make ourselves strong". We have demonstrated this strong will in recent years by supporting and standing up for one another during difficult times.

It is good to see the gradual end of the pandemic in sight and a longing to return to some resemblance of normalcy.

With the second quarter ending in June, the chapter continued to host its regular monthly EC meetings and monthly technical talks in virtual mode. Our chapter also had the honour to host 2 physical meetings at the National level with ASM INC (India National Council) chair and ASM ITF (India Task force). Details of the chapter activities are provided in the newsletter.

One must be familiar with the adage, "If you want to go fast, go alone; if you want to go far, go together". This proverb is quite apt to the organisation such as ASM wherein an individual has sustained as member, and it truly speaks volumes about our association with ASM. Bangalore Chapter is no exception to it. ASM membership is strong, but we need all our members, particularly the council members to join in, get engaged in terms of identifying and approaching prospective members for enrolment in the chapter. It's only through our vast membership that the ASM's voice carries the weight it does. In other words: "There's strength in numbers".

Our chapter will soon be announcing programmes in association with other local professional societies the details of which will be circulated shortly. I request all our members to participate actively in all the chapter affairs with this spirit of contribution thereby making each and every event a great success.

Jyothi Sriram

ASM INTERNATIONAL

Bangalore Chapter – News Letter

Issue 9 - July 2022

About ASM International

ASM International formerly known as the American Society for Metals was established in 1913 as a professional body of heat treaters. It has since evolved as an international professional body of material scientists, engineers, R&D professionals and academicians with the motto of collecting &disseminating knowledge on Materials and Processes. The worldwide network of more than 38,000 individuals is led by members, guided by members' needs and fueled by members' participation.

About ASM Bangalore Chapter

ASM Bangalore chapter is actively involved in dissemination of materials centric knowledge among working professionals, researches and academicians. ASM Bangalore chapter began its activities in the year 2006. Since then it has dedicated itself in spreading information based on materials among various stakeholders. Bangalore is a strategic center for several major automotive, aerospace, defense & R&D institutes and thousands of engineering professionals and it is imperative to educate & connecting the community in the field of Metals & Material science Technology. Under the able leadership of present chairperson Mrs. Jyothi Sriram and capable Office Bearers, ASM Bangalore chapter is gaining wide popularity by activity involving and supporting the technological up-gradation of Engineering community.

The Prime Objectives of ASM Bangalore Chapter:

1. To disseminate materials centric information among professionals by organizing seminars, lectures, One/two days' workshops
2. To bring together Scientists, Intellectuals and Professionals working in the field of materials science to exchange ideas/knowledge/information.
3. To encourage and support student chapters among various Engineering colleges in the state of Karnataka and enlighten them, the importance of materials properties, selection and its application.
4. To Promote consultancy services by ASM members to solve industry problems in the area of materials.
5. To recognize and award ASM members for their contributions to field of materials science.

ASM Bangalore chapter has members with rich expertise and professional experience with deep insight to practical applications in the field of materials science & engineering. ASM Bangalore chapter offers consultancy in the broad areas of Material selection &Characterization, foundry practices, mechanical testing, forging, heat-treatment, failure analysis, Corrosion control, Nondestructive Evaluation (NDE), process simulation to name a few.

ASM Membership

A membership in ASM gives you every imaginable edge you seek in your career.

VISIT - **http://www.asmblrchapter.com/membership.php** - for Benefits and Forms

Or Call Membership Chair – Mr. Manohar Hegde – 9901964251 / Mr. K. L. Srirama - 9845699661

Or write ASM Bangalore Chapter : asmblr2015@gmail.com

ASM INTERNATIONAL
Bangalore Chapter – News Letter
Issue 9 - July 2022

Featured Articles:

Dhātu-yantra pravartana

Writing and editing: Priyanka Saini and Stuti Lohani

Laboratory for Multi-scale Mechanical Behaviour of Materials

When you bring together some of the best minds in materials science and engineering to work and study, they inevitably collaborate to develop research projects with real-world applications to drive the field forward. Seven dedicated researchers constitute the Dhātu-yantra pravarta□a research group in the Department of Materials Science and Engineering at IIT Delhi; among them, Prof. Lakshmi Narayan R, an Assistant Professor, three prime minister research fellows (PMRF) and one senior scientist at CSIR-IMMT, Bhubaneswar (Fig.1). Together, they work on solving fundamental scientific and technological challenges pertaining to processing-structure-property correlations in all types of metals and alloys. The goal of this research group, which operates in the materials/mechanics domains, is to support and innovate in the field of manufacturing, materials development and characterization, which will go a long way in ensuring the structural integrity and reliability of components.

To achieve these goals, the team examines mechanical behaviour at multiple length scales of advanced metallic alloys and focusses on their fatigue, fracture, and indentation behaviour. These tests are performed using various resources present in their own lab, namely Industron Nanoguru NG50, Rotating Bending Fatigue Testing Machine, and Holmarc Telemicroscope (Fig.2). For support, complementary characterization facilities such as scanning electron microscopy (SEM), X-ray diffraction (XRD), X-ray fluorescence (XRF), electron back-scatter diffraction (EBSD), and Transmission electron microscopy (TEM) are available in IITD. The advanced materials currently under research are additively manufactured (AM) high entropy alloys, aluminium alloys (all series), titanium alloys, maraging steels, Ni-base superalloys, cobalt-chromium alloys and conventionally manufactured Heusler alloys, reactor pressure vessel steels, bulk metallic glasses (BMGs) and BMG composites (BMGCs).

The use of AM is considered to be a new industrial revolution, right after steam engines, computers, and the internet. Unlike subtractive manufacturing or conventional manufacturing, metal AM generally builds a part using a layer-wise process with feedstock materials in the form of powders, wires, or sheets. Energy sources such as laser beams, electron beams, arcs, or ultrasound are utilised to fuse the molten metal. AM processes have significant advantages over conventional manufacturing processes, such as a high buy-to-fly ratio, high strength, high fracture toughness, and complex geometry production with minimal support structures.

AM methods are classified into powder bed fusion (PBF), direct energy deposition (DED), binder jetting (BJ), and sheet lamination (SL). Of all these, the most prominent is laser powder bed fusion (LPBF), as it offers the best reproducibility and dimensional accuracy within metal AM production. LPBF is still at its early stages of development; the fundamental processing microstructure-property relationships are not fully understood yet. Without optimised processing parameters (like powder morphology, size, laser power, spot size), defects (such as lack of fusion, keyhole collapse, gas porosity, solidification cracking, solid-state cracking, and surface-connected porosity) can often occur in AM parts, as shown in Fig. 3 and 4. Thus, our study attempts to optimise the process parameters of heat source power and scan speed, to minimize process-induced defects. Another challenge with AM technology is the lack of effective strengthening methods that are non-destructive to the near net shape of AM components. Therefore, our research group also focuses on identifying optimum post-processing methodologies that can significantly enhance the mechanical properties of AM alloys without distorting the shape.

The lab also has two groups of undergraduate students who are working on some fundamental aspects of 3D printing. The first research team works on designing and prototyping a food printer. This printer, which can be used for developing customized food items from any raw material, has far reaching applications in the industries of healthcare (particularly for patients with dysphagia) and food gastronomy. The other team's work involves crystal structures, specifically, developing material models to study graphene structures and dislocations. These models could potentially be used for educational purposes, enabling material science students to get a more visual learning experience. All this happens with the assistance of Makerspace, IIT Delhi's DIY educational facility.

We also conduct failure analysis of engineering components using non-destructive investigative tools and offer remedies and solutions. Some new alloys with good physical and mechanical properties were developed cost-effectively by employing micro and macro alloying strategies. This work is on the verge of compilation and will likely be patented. We work on these projects in collaboration with ArKE filters, Vedanta, Objectify Technologies Pvt. Ltd and Cyient Technologies. We also have tie-ups with researchers and scientists from NTU Singapore, NUS Singapore, Shenyang National Laboratory, China, Xi'an Jiatong University, China, Dalian Jiaotong University, China, HZB Dresden, IIT Bhubaneshwar, IIT Jodhpur, NIT Nagpur.

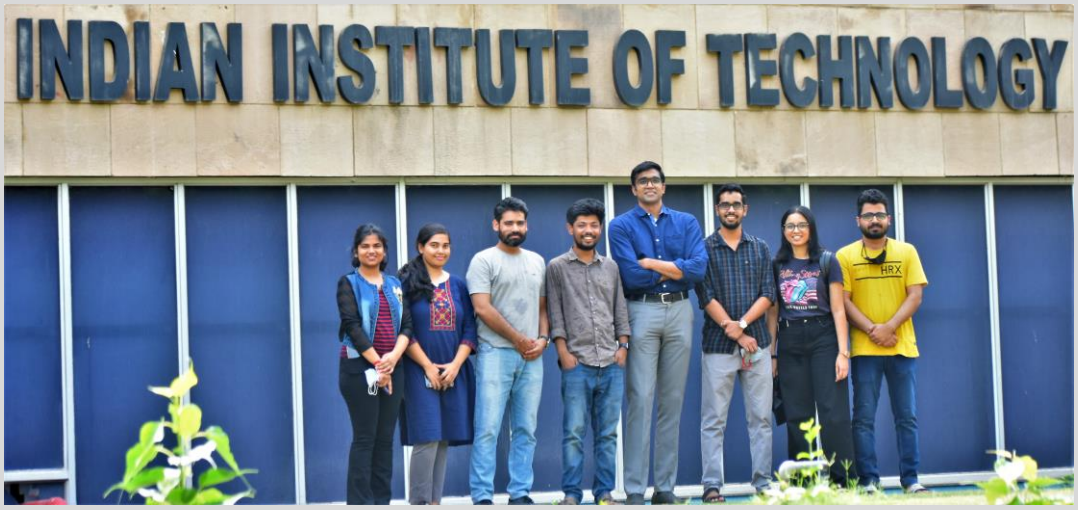


Fig. 1: Dhātu-yantra pravartana research group

Fig. 2: Equipment in the laboratory for multi-scale Mechanical Behaviour of Materials (a) Industron Nanoguru NG50 (b) Rotating bending fatigue testing machine (c) Holmarc Telemicroscope

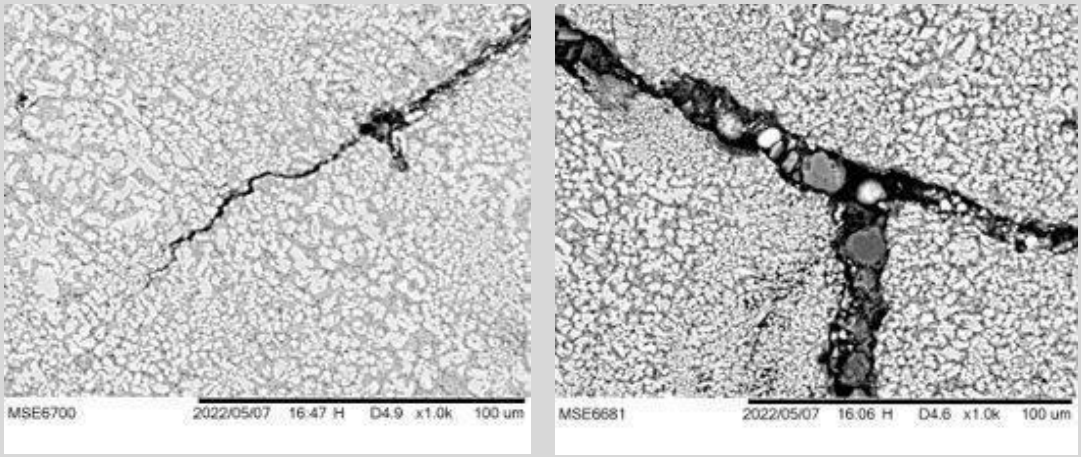


Fig. 3: Cracks observed in LPBF processed Aluminium alloys

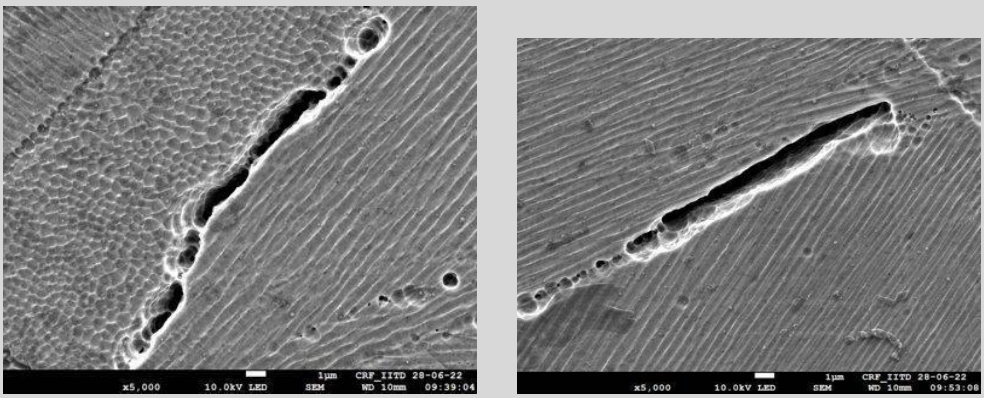


Fig. 4: Solidification cracks observed in LPBF processed Co-Cr alloy

ASM INTERNATIONAL
Bangalore Chapter – News Letter
Issue 9 - July 2022

An insightful experience at IISc, Bangalore

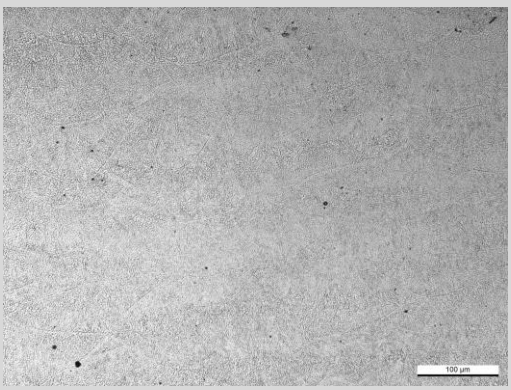
Heat treatment development for additively manufactured m4pTM type13-X martensitic stainless steel

- JATIN RATHORE

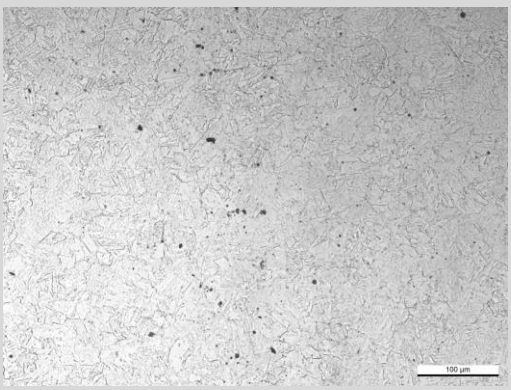
Final year student, Department of Metallurgy and Materials Engineering, VNIT Nagpur

Along with the development of the oil and gas sector with current market needs, there is also increasing demand for the material being used. Such is a material m4p™ type13-X (CA6NM). CA6NM is a low carbon martensitic steel that is differentiated in Class A and B, A directed towards strength and the latter one towards ductility. Interestingly, both of them contain the same composition although most of the applications fall under Class B which is ultimately used in oil and gas industries.

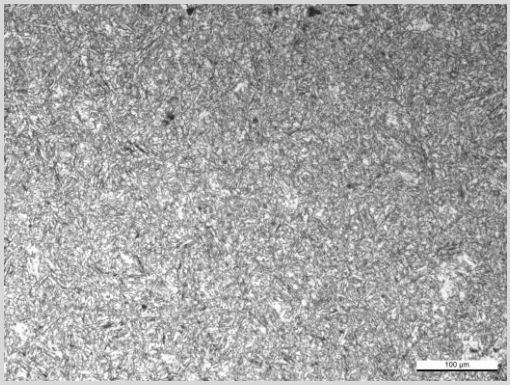
I got a wonderful opportunity to work on CA6NM Class-A by Dr. Priyanshu Bajaj to reduce its hardness so that it can be used in the oil and gas industries. To continue my research project surprisingly I got access to one of the most prestigious colleges in India I.e., IISC Bangalore. Under the guidance of Dr. Surendra Makineni and his A3D lab, I started my work. One fun fact about my ongoing bachelor's Is that I was once an online student so you can very well guess that I had zero lab experience, whatever I learned was basically from scratch. As a fellow metallurgist, my initial job was to learn the most underrated thing which is polishing, during the start it used to take me literally a whole day to polish one sample, and used to complain to my seniors Ph.D.'s how tiresome it was, but as days passed, I understood the proper technique and value of polishing. Moving on forward learning about etching took me on my nerves, to prepare a suitable etchant and deciding its etching time consumed lots of my time. I was successful in chemically etching my sample but the features were not clear so shifted to electro etching using a platinum wire as a cathode and oxalic acid as an electrolyte and the microstructures, I obtained were so good, here are some examples.



As-Built



Solutionised



Tempered

Carrying out heat treatments was the next thing I had to learn starting from planning the heat treatment cycles to using furnaces. Since the samples were Martensitic Steel and the only way to reduce the hardness is by doing solutionizing and multiple tempering, it's playing with temperature and time. The idea behind the planned heat treatment was to homogenize the structure and coarsen out the martensitic lath eventually giving us some lower hardness. For more characterization I did XRD, and EBSD of the heat-treated sample to observe the changes. I obtained the desired results by using the automatic Rockwell hardness tester and to verify those results when I performed the Vickers test there I could see some discrepancies, the conclusion to it was that using the small sample on a high-loading testing machine will give you errors. Right now, Priyanshu Sir and I have decided to work on a larger sample and try out some other heat treatments and I hope soon we will obtain the results. Aside from my project, I did some other experiments such as Casting, and DSC which were cool.

During the internship I got to meet some passionate Ph.D. students, having a conversation about materials was always a blessing I can certainly say that I was in a room full of geniuses, not only the seniors but I also worked with some aspiring metallurgist of my age. Though my stay was short I got to experience joy, frustration, and satisfaction during this research work. Amidst all this exploring Bangalore city was totally on a different level it was bright, fresh, and exciting. As for my plans, IISC Bangalore made an appetite for me to learn more about materials science and soon work professionally with Priyanshu Bajaj Sir.

Brief Biodata of the Author

I am Jatin Rathore, a final year student at Visvesvaraya National Institute of Technology Nagpur, pursuing my bachelor's degree in Metallurgical & Materials. I have a keen interest in characterization of the material along with changes brought upon by heat treatments on the microstructure.

ASM INTERNATIONAL
Bangalore Chapter – News Letter
Issue 9 - July 2022

Calendar of Events

Special Events & Highlights

ASM Bangalore Chapter Members Meet

Get-together of ASM Bangalore Chapter Members was organized April 29, 2022 at Bangalore Golf Club. About 25 members participated in the Meet.

Date / Venue	April 29, 2022 @ Bangalore Golf Club

ASM INTERNATIONAL
Bangalore Chapter – News Letter
Issue 9 - July 2022

Visit by Dr. A.K. Tiwari, INC Chairman

In view of the visit of Dr. A.K. Tiwari, INC Chairman, a meeting of ASM (I) Bangalore Chapter EC Members was arranged at Bangalore Golf Club.

Date / Venue	May 31, 2022 @ Bangalore Golf Club

Visit by Prof. Ravi Ravindran

In view of the visit of Prof. Ravi Ravindran, a meeting of ASM (I) Bangalore Chapter EC Members was arranged at Bangalore Golf Club.	
Date / Venue	16th June 2022 @ Bangalore Golf Club

ASM INTERNATIONAL
Bangalore Chapter – News Letter
Issue 9 - July 2022

Events Calendar 2021-23

1. Memberships	Drive by Headquarter / India Task Force
2. Monthly Technical Talks	To improve consistency and Participation
3. Student Outreach	a) Events for Students – Talks + Industrial Visits b) Membership & Student Chapter Formation c) Support in Projects / Training d) Material Camps
4. Major Events	a) One/Two Days Workshops / Seminars b) Annual Get-together c) Annual General Body Meeting d) Hosting of INC Meeting / Visiting ASM Leaders e) Support to other ASM Chapters / Local Associations in their events.
5. Technical Talk	Every 3rd Saturday 5.00 pm
6. Executive Council Meetings	This Qtr. – April 23, 2022 ; June 25, 2022 ;

ASM International Bangalore Chapter cordially welcomes the following New Members who have joined during the period – From 1st April 2022 to 31st June 2022:

Sl. No.	Names of the New Members
1	Mr. S. Chandra Sekaran, Tata Advanced Systems Limited