

Dr. MAINAK SEN
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WORK EXPERIENCE

- i. Project Scientist. Materials Engineering Dept. IISC Bangalore. (Prof. Dipankar Banerjee Lab) (January 2023 – Present)**
 - Characterization of Fatigue samples by EBSD and ECCI.
 - Creep in Ti alloy.
 - TEM of crept samples.
 - DIC in Ti alloy

- ii. SERB-National Post Doctorate Fellow. Materials Engineering Dept. IISC Bangalore. (Prof. Dipankar Banerjee lab) (January 2021-January 2023)**
Responsibility:
 - Micromechanical modeling of mechanical behavior in a multiphase β titanium alloy.
 - Digital image correlation for strain partitioning system development along with new techniques of nano scale speckle pattern generation.
 - Compression and Tensile testing of Ti alloy.
 - Electron back scattered diffraction and Scanning electron microscopy.
 - Transmission electron microscopy and Scanning electron Microscopy.
 - Focused Ion Beam (FIB) for site specific sample preparation for EBSD and TEM.

- iii. Post-Doctoral Research Associate. Materials Engg. Dept. IISC Bangalore. (Prof. Dipankar Banerjee lab) (January 2020-January 2021).**
Responsibility:
 - Low cycle fatigue of Ti6242 and Ti6246 alloy.
 - Mechanical testing of Ti alloy.
 - Microstructure characterization.
 - Transmission electron microscopy and Scanning electron Microscopy.
 - Electron back scattered diffraction and electron channeling contrast imaging

PROJECTS

- I. Plasticity in High strength Beta Titanium alloy. (Funded by Asian Office of Aerospace research and Development (AOARD) USA).**
 - Determination of plasticity in high strength beta titanium (Ti-5Al-5Mo-5V-3Cr alloy).
 - Mechanical testing along with digital image correlation (DIC).
 - Electron backscattered diffraction (EBSD) to identify the effect of orientation in strain partitioning.

- II. Titanium Microstructure Effects on HCF/LCF. (Funded by Pratt & Whitney).**
 - Low cycle Fatigue of Ti-6Al-2Sn-4Zr-2Mo and Ti-6Al-2Sn-4Zr-6Mo.
 - Effect of microstructure on the LCF properties of both the alloys.
 - EBSD analysis to identify the effect of texture.
 - Crack initiation and propagation analysis along with fracture surface study.
 - Design of heat treatments to identify the effect of microstructural constituents on fatigue properties of the alloy.

SKILLS & EXPERTISE

Expertise: Characterization of materials, Texture analysis, Mechanical Metallurgy, Electron Microscopy, Diffraction techniques, Phase transformation and deformation mechanism of Ti alloy, Welding, Additive manufacturing.

Skills: Scanning electron microscope (SEM), Transmission Electron Microscope (TEM), Electron backscattered Diffraction (EBSD), Focused ion beam (FIB), Mechanical Testing (Tensile, compression, Fatigue and Creep), Digital image correlation (DIC), Differential Scanning Calorimetry (DSC) and Differential Thermal Analysis (DTA), Microhardness, Macro hardness, X-Ray Diffraction (XRD).

CERTIFICATIONS

- I. Continuing Education online course on “Fundamentals of Machine learning” conducted during Jan-May 2022 under CCE proficiency program by Centre for Continuing Education, Indian Institute of Science (IISC-Bangalore).
- II. Pre-conference workshop on electron microscopy organized by BARC, Mumbai & EMSI West zone chapter held at IIT Mumbai on 6 – 7th July 2015.
- III. Attended the AWS lecture series VI on “Welding of Stainless Steel (emphasis on metallurgical aspect of duplex stainless steel and role of shielding gases)” organized by IIW, Kolkata branch held on 16.01.2013.
- IV. Attended the pre- conference tutorial on “Welding in manufacturing and infrastructure industries” organized by IIW, Kolkata at the Annual Seminar WELD-2012 on 30.11.12.
- V. Attended the Workshop on “Advancement in welding technology (workshop AWT)” organized by IIW, Kolkata Branch in association with Jadavpur university held on 25.02.12.

TECHNICAL QUALIFICATION

2019	PhD from Metallurgical and Materials Engg. Dept. (Topic: Microstructure evolution and deformation mechanisms under tensile and cyclic loading in Ti-5Al-5Mo-5V-3Cr alloy.)	IIT Kharagpur	Defence on 21.06.2020
2013	M.E in Metallurgical Engineering. (Topic: The influence of double pulse on bead profile and microstructure in gas metal arc welding of low carbon steel.)	Jadavpur University	8.25 / 10
2009	B.E in Production Engineering	NIT Agartala	84.85%

AWARDS & ACHIEVEMENTS

1. Topper in B.E in the department

Awarded gold medal for being the branch topper in B.E in Production Engineering at NIT Agartala

2. Topper in M.E in the department

Awarded gold medal for being the branch topper in M.E in Metallurgical Engineering at Jadavpur University

3. Best Poster award in nonferrous category at NMD ATM2015

Best Poster award in nonferrous category titled “Tensile Deformation of Ti5553 Alloy for Aircraft Structural Application” at NMD-ATM 2015 held at Coimbatore from 16-19th Nov 2015.

4. First prize for Metallographic Contest on research scholar day 2017

First prize for Metallographic Contest (TEM category) on research scholar day 2017 held at Department of Metallurgical And Materials Engineering, IIT Kharagpur.

5. Second prize for Oral presentation on research scholar day 2017

Second prize for Oral presentation on research scholar day 2017 held at Department of Metallurgical And Materials Engineering, IIT Kharagpur.

6. First prize for Metallographic Contest on research scholar day 2018

First prize for Metallographic Contest (TEM category) on research scholar day 2018 held at Department of Metallurgical And Materials Engineering, IIT Kharagpur.

7. Consolation prize for poster presentation (select among 10 best poster) in EMSI 2018

Consolation prize for poster presentation (select among 10 best posters) in EMSI 2018 held at Bhubaneswar, India from 18-20 July 2018.

8. First prize for poster presentation in Advances in Material Science & Engineering category at NMD 2020.

Best poster award titled “Strain Partitioning between the α and β phases in a Titanium Alloy by Microscale Digital Image Correlation” at NMD ATM held at Bombay from 23-26 Feb, 2021.

9. First prize for Metallographic Contest in Advanced Technique category at NMD ATM 2020.

First prize for Metallographic Contest (Advanced Technique category) for 3D reconstruction of α phase in Ti-5Al-5Mo-5V-3Cr alloy at NMD ATM held at Bombay from 23-26 Feb, 2021.

PUBLICATIONS

1. Ankita Bhattacharya, Rakesh Kumar Barik, Supriya Nandy, **Mainak Sen**, TS Prithiv, Sudipta Patra, Rahul Mitra, Debalay Chakrabarti, Abhijit Ghosh; Effect of martensite twins on local scale cleavage crack propagation in a medium carbon armor grade steel. **Materialia**. 2023. Vol 30. 101800. <https://doi.org/10.1016/j.mtla.2023.101800>.
2. Syed Idress Afzal Jalali, **Mainak Sen**, Dipankar Banerjee; Strain Mapping in Fine Scale Multivariant α Structures in Titanium Alloys. **Material Characterization**. 2022. Vol 193. 112260. **IF: 4.537**. <https://doi.org/10.1016/j.matchar.2022.112260>.

3. **Mainak Sen**, S. Suman, S. Mukherjee, T. Banerjee, S. Sivaprasad, S. Tarafder, A. Bhattacharjee, S. K. Kar; Low cycle fatigue behavior and deformation mechanism of different microstructures in Ti-5Al-5Mo-5V-3Cr alloy. **International Journal of Fatigue**. 2021. Vol 148. 106238. IF: 5.489. <https://doi.org/10.1016/j.ijfatigue.2021.106238>.
4. **Mainak Sen**, Sujoy Kumar Kar, Trideep Banerjee, Amit Bhattacharjee, Amlan Dutta, Srikumar Banerjee; Anomalous Dilatometric Response of Hot-Worked Ti-5Al-5Mo-5V-3Cr Alloy: In Terms of Evolution of Microstructure, Texture and Residual Stress. **Metallurgical And Materials Transactions A**. 2020. Vol 51A. pp 2011-2024. IF: 2.726. <https://doi.org/10.1007/s11661-020-05707-2>.
5. **Mainak Sen**, Swati Suman, Trideep Banerjee, Amit Bhattacharjee, Sujoy Kumar Kar; Tensile Deformation Mechanism and Failure Mode of Different Microstructures in Ti-5Al-5Mo-5V-3Cr Alloy. **Material Science & Engineering A**. 2019. Vol 753. Pp 156-167. IF: 6.044. <https://doi.org/10.1016/j.msea.2019.03.003>.
6. **Mainak Sen**, Swati Suman, Mukesh Kumar, Trideep Banerjee, Amit Bhattacharjee, Sujoy Kumar Kar; Thermo- mechanical processing window for phase recrystallization in Ti-5Al-5Mo-5V-3Cr alloy. **Material Characterization**. 2018. Vol 146. pp 55-70. IF: 4.537. <https://doi.org/10.1016/j.matchar.2018.09.038>.
7. **Mainak Sen**, M Mukherjee, S K Singh, T K Pal; Effect of double-pulsed gas metal arc welding (DP- GMAW) process variables on microstructural constituents and hardness of low carbon steel weld deposits. **Journal of Manufacturing Processes**. 2018. Vol 31. pp 424-439. IF: 5.684. <https://doi.org/10.1016/j.jmapro.2017.12.003>.
8. **Mainak Sen**, Manidipto Mukherjee, Tapan Kumar Pal; Evaluation of Correlations between DP-GMAW Process Parameters and Bead Geometry. **American Welding Journal**. 2015. Vol 94. pp 265s-279s. IF: 0.5.
9. Arka Mandal, Pranabananda Modak, **Mainak Sen**, Shiv Brat Singh, Debalay Chakrabarti; Influence of local microstructure on the dislocation transference and micro-mechanical response in metastable fcc alloy. **Journal of Materials Science**. 2022. Vol 57. pp 1390-1402 IF: 4.682. <https://doi.org/10.1007/s10853-021-06605-7>.
10. Arka Mandal, Swapnil Morankar, **Mainak Sen**, Santigopal Samanta, Shiv Brat Singh, Debalay Chakrabarti; A Descriptive Model on the Grain Size Dependence of Deformation and Martensitic Transformation in Austenitic Stainless Steel. **Metallurgical And Materials Transactions A**. 2020. Vol 51. pp 3886-3905. IF: 2.726. <https://doi.org/10.1007/s11661-020-05861-7>
11. Kartik Maity, Devdeep Mukherjee, **Mainak Sen**, Kumar Biradha; Fluorescent dye-based metal-organic framework piezochromic and multicolor-emitting two-dimensional materials for light emitting devices. **ACS Applied Nano Materials**. 2019. Vol 2. pp 1614-1620. IF: 6.140. <https://doi.org/10.1021/acsanm.9b00055>.
12. Rajib Chakraborty, Jhimli Sarkar Manna, Debmalya Das, **Mainak Sen**, Partha Saha; A comparative outlook of corrosion behaviour and chlorophyll assisted growth kinetics of various carbon nano-structure reinforced hydroxyapatite-calcium orthophosphate coating synthesized in-situ through pulsed electrochemical deposition. **Applied Surface Science**. 2019. Vol 475. pp 28-42. IF: 7.392. <https://doi.org/10.1016/j.apsusc.2018.12.217>.
13. Rajib Chakraborty, Venkata S. Seesala, **Mainak Sen**, Srijan Sengupta, Santanu Dhara, Partha Saha, Karabi Das, Siddhartha Das; MWCNT reinforced bone like calcium phosphate-hydroxyapatite composite coating developed through pulsed electrodeposition with varying amount of apatite phase and crystallinity to promote superior osteoconduction, cytocompatibility and corrosion protection performance compared to bare metallic implant surface. **Surface and Coating technology**. 2017 Vol 325. pp 496-514. IF: 4.865. <https://doi.org/10.1016/j.surfcoat.2017.06.073>.
14. K. Sajun Prasad, Sushanta Kumar Panda, Sujoy Kumar kar, **Mainak Sen**, S.V.S. Naryana Murty, Sharad Chandra Sharma; Microstructure, Forming Limit and Failure Analyses of Inconel 718 Sheets for Fabrication of Aerospace Components. **Journal of Materials Engineering Performance**. 2017. Vol 26. Issue 4. pp 1513-1530. IF: 2.036. <https://doi.org/10.1007/s11665-017-2547-4>.

CONFERENCES

1. TMS 2018 at USA

Mainak Sen, Swati Suman, Trideep Banerjee, Sujoy Kumar Kar; Low cycle fatigue behavior and micromechanics of a beta titanium alloy Ti-5Al-5Mo-5V-3Cr. The Minerals, Metals & Material Society. 147th Annual Meeting and Exhibition. (TMS 2018). Phoenix, Arizona. USA. 11-15 Mar 2018.

2. TMS 2016 at USA

Mainak Sen, Swati Suman, Amit Bhattacharjee, Sujoy Kumar Kar; Study of phase transformation, recovery, and recrystallization in Ti-5Al-5V-5Mo-3Cr alloy and their effects on dilatometric response. The Minerals, Metals & Material Society. 145th Annual Meeting and Exhibition. (TMS 2016). Nashville, Tennessee. USA. 14-18 Feb 2016.

3. ICAMMP-IV at IITKharagpur

Mainak Sen, Sujoy Kumar Kar; Tensile deformation mechanism of a titanium alloy for aircraft structural application. The 4th International Conference on Advances in Materials & Materials Processing. ICAMMP-IV. IIT Kharagpur. 5-7 Nov 2016.

4. NMD ATM 2018 - 56th National Metallurgist Day & 72nd Annual Technical Meeting (NMD-ATM 2018). Kolkata. 15-16 Nov 2018.

5. NMD ATM 2015 - 53rd National Metallurgist Day & 69th Annual Technical Meeting (NMD-ATM 2015). Coimbatore. 13-16 Nov 2015.

6. NMD ATM 2014 - 52nd National Metallurgist Day & 68th Annual Technical Meeting (NMD-ATM 2014). Pune; 12-15 Nov 2014.

7. CF-7 2016

Kaustav Barat, **Mainak Sen**, Alok Doharey, Mainak Ghosh, S. Sivaprasad, S. Tarafder and Sujoy Kumar Kar; Mechanism of low cycle fatigue crack growth in a polycrystalline Ni based superalloy. 7th International Conference on Creep, Fatigue and Creep-Fatigue Interaction (CF-7). Indira Gandhi Centre for Atomic Research, Kalpakkam, Tamil Nadu, India. 19-22 Jan. 2016.

8. AIMTDR 2014

Mainak Sen, Manidipto Mukherjee and Tapan Kumar Pal: "Prediction of Weld Bead Geometry for Double Pulse Gas Metal Arc Welding Process By Regression Analysis", Proceedings of 5th International and 26th All India Manufacturing Technology, Design and Research Conference AIMTDR 2014 hosted by IIT Guwahati, Guwahati, India, December 12-14, 2014.

9. AFTMME 2014

M. Sen, M. Mukherjee and T. K. Pal: "Investigation for Controlled Double Pulse GMAW Through Response Surface Methodology Based Approach" International Conf. on Advancements and Futuristic Trends in Mechanical and Materials Engineering, Organized by Punjab Technical University, Punjab, October 16-18, 2014.

Member of Professional Bodies

- Electron Microscope Society of India (EMSI). – Life Member.
- Indian Institute of Metals (IIM). – Life Member

INTERNSHIP

IISCO Steel plant

15 days Industrial training at SAIL IISCO steel plant Burnpur

ACADEMIC CREDENTIALS

2005	Higher Secondary (12 th) (Physics, Chemistry, Math, Biology)	Tripura Board of Secondary Education	70.1%
2003	Secondary (10 th) (All Subjects)	Tripura Board of Secondary Education	76.23%

EXTRA CURRICULAR ACTIVITIES

1. Research Scholar representative of department for the year 2015-2016.
2. Mess secretary of B. C. Roy Hall of residence for the year 2015-2016.

REFERENCES

1. Prof. Dipankar Banerjee.
Honorary Professor. Materials Engineering Department. IISc Bangalore.
Email: dbanerjee@iisc.ac.in
2. Prof. Sujoy Kumar Kar.
Professor. Metallurgical and Materials Engineering Department. IIT Kharagpur.
Email: sujoy.kar@metal.iitkgp.ac.in
3. Dr. Amit Bhattacharjee.
Group Head. Titanium alloy Group. Defence Metallurgical Research Laboratory (DMRL), Hyderabad.
Email: amitrachb@yahoo.co.in

I hereby declare that all the above information's are true and correct to the best of my knowledge.

Date: 3 June 2023

Place: Bengaluru

Mainak Sen

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