CURRICULUM VITAE

AVANISH KUMAR

Assistant Professor

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Education

Degree	Institute/University	Year	CGPA
PhD	Department of Metallurgical Engineering and Materials Science, IIT Bombay, Maharashtra	2016 - 2021	9.86/10
MTech Materials Science and Engineering	School of Minerals, Metallurgical and Materials Engineering, IIT Bhubaneswar, Odisha	2013 - 15	8.65/10
BE Mechanical Engineering (Manufacturing)	Faculty of Engineering and Technology Annamalai University, Tamilnadu	2009 - 13	9.11/10

Professional Experience

August 2021 – present **Assistant Professor**

Indian Institute of Technology (ISM) Dhanbad, Department of Fuel, Minerals and Metallurgical Engineering, Dhanbad, Jharkhand

Teaching Experience:

- FMC303-*Mechanical Metallurgy* (Core course, 6th Semester BTech)
- FMC352-*Heat-treatment & Mechanical Metallurgy Lab* (6th Semester BTech)
- FMD403-*Engineering Materials Selection & Design* (Institute elective, 5th & 7th Semester BTech and PhD)
- NFME101-*Introduction to Materials Science & Engineering* (Engineering Science Compulsory to 1st Semester BTech - Chemical Engineering)

Research supervision:

- PhD: Ongoing - 01 Full-time and 03 Part-time
- MTech: Ongoing – 02, Completed – 01
- BTech: Ongoing – 04, Completed – 04

Jul 2016 – July 2021	**Teaching Assistant** Indian Institute of Technology Bombay, Department of Metallurgical Engineering & Materials Science, Mumbai, Maharashtra UG courses – Mechanics of materials, Mechanical testing lab, Mechanical working of metals PG courses – Fatigue of materials
August 2015 – May 2016	**Ad-hoc Faculty** National Institute of Technology Warangal, Department of Metallurgical & Materials Engineering, Warangal, Telangana **Courses taught** – Mineral processing, Phase-transformations and heat treatment, Mineral processing lab., Physical metallurgy and heat treatment lab.

Research Projects

- Ministry of Mines, Govt. of India, S&T Scheme, 2024, Amount – 26.04 Lakhs (PI)
- DST-FIST Engineering Sciences Level B C or D – Project, 2023, Amount – 2.87 Crores (Co-PI)
- IIT(ISM) Dhanbad, Faculty Research Scheme, 2021. Amount – 15 Lakhs (PI)

Academic Projects

PhD Thesis: Effect of Austempering Temperature on the Damage Resistance and Tolerance of Nano-Bainitic Steels

Abstract: Three distinct nanostructured bainitic steels with strength above 1 GPa were developed by austenitization followed by austempering treatments. A lower austempering temperature led to formation of finer microstructure and showed better strength under tensile as well as torsional loading. However, better ductility was obtained in steels with higher content of retained austenite (RA) which were austempered at higher temperatures. Better damage tolerance in terms of impact and plane strain fracture toughness at higher austempering temperature was observed primarily due to higher content of relatively stable RA in spite of its coarser morphology. Sub-critical fatigue crack growth investigation revealed that the specimen with the coarser microstructure and highest RA content showed the largest crack growth threshold and marginally slower crack growth rates in all the stages of fatigue crack growth rate test. The larger plastic zone size, higher amount of strain energy consumed during austenite to martensite transformation and tortuous crack path are the main factors for slower fatigue crack propagation rates in steel with the coarser microstructure and higher RA content.

MTech project: Synthesis of Immiscible Cu-20 wt.% Mo Alloy by Mechanical Alloying

Abstract: An immiscible Cu-Mo alloy was developed as anode material for high power microwave devices using mechanical alloying. Different sintering techniques (vacuum, hydrogen and vacuum hot press) were utilized to consolidate the material. A good combination of thermal and electrical conductivity along with low coefficient of thermal expansion and higher hardness was obtained for vacuum hot press sintered compacts.

BE project: Characterization of Titanium-6Al-4V Alloy

Abstract: Ti-6Al-4V alloy, an aerospace material was heat-treated by solutionizing followed by ageing. Heat-treated specimens were characterized for thermal fatigue through micro hardness measurements.

Summer School/Workshop/Training

1st Virtual European Structural Integrity Society Summer School (VESS1) - 07/2020

Recent Advances in Nano Indentation Techniques Workshop, IIT Bombay - 12/2019

Research Writing and Science Communication Workshop, IIT Bombay - 11/2019

9th Patent Searching and Drafting Workshop, IIT Bombay - 02/2019

Intellectual Property (IP) and its Management workshop, IIT Bombay - 10/2018

Thermo-Calc Training, IIT Bombay - 03/2017

Scientific Skill/Experience

Dilatometry, X-ray diffraction, Optical microscopy, Scanning electron microscopy, Transmission electron microscopy, Mechanical testing (Tensile, Torsion, Impact, Fracture and Fatigue), Nanoindentation, Mechanical alloying, Sintering, Induction melting, Salt-bath treatments, Hydrogen Embrittlement

Patents

Avanish Kumar, Aparna Singh: *High strength and toughness low carbon nanostructured bainitic steel and preparation method thereof*. Indian Patent Number: 540248

Journal Publications

Sudharm Rathore, Avanish Kumar, Anurag Kumar, Kushal Mishra, Aparna Singh: *Prediction of sub-critical fatigue crack growth rate in a high-carbon tempered martensitic steel at varying R ratio: experimental investigation and machine learning based modelling*. International Journal of Fatigue 193 (2025) 108804.

Avanish Kumar, B. Blessto, Aparna Singh: *Development of a low-carbon carbide-free nanostructured bainitic steel with extremely high strength and toughness*. Materials Science and Engineering A 877 (2023) 145186.

Bhawesh Chhajed, B. Blessto, Avanish Kumar, Aparna Singh: *Effect of torsional deformation on crystallographic evolution of carbide-free nano-bainitic steels prepared at two different austempering temperatures*. Materialia 28 (2023) 101773.

Avanish Kumar, B. Blessto, Aparna Singh: *Effect of austempering temperature on high cycle fatigue behaviour in nanostructured bainitic steels*. Materials Science and Engineering A 846 (2022) 143296.

Avanish Kumar, Aparna Singh: *Mechanical properties of nanostructured bainitic steels*. Materialia 15 (2021) 101034.

Avanish Kumar, Aparna Singh: *Deformation mechanisms in nanostructured bainitic steels under torsion*. Materials Science and Engineering A 770 (2020) 138528.

Avanish Kumar, Aparna Singh: *Microstructural effects on the sub-critical fatigue crack growth in nano-bainite*. Materials Science and Engineering A 743 (2019) 464–471.

Avanish Kumar, Kritika Singh, Aparna Singh: *Compositional design of high strength nanostructured bainite*. Materials Research Express 6(2) (2019) 026526.

Avanish Kumar, Aparna Singh: *Toughness dependence of nano-bainite on phase fraction and morphology*. Materials Science and Engineering A 729 (2018) 439–443.

Kritika Singh, Avanish Kumar, Aparna Singh: *Effect of prior austenite grain size on the morphology of nano-bainitic steels*. Metallurgical and Materials Transactions A 49(4) (2018) 1348-1354.

Avanish Kumar, S K Pradhan, K Jayasankar, M Debata, R K Sharma, A Mandal: *Structural investigations of nanocrystalline Cu-Cr-Mo alloy prepared by high energy ball milling*. Journal of Electronic Materials - 46(2) (2017) 1339–1347.

Avanish Kumar, K. Jayasankar, M. Debata, A. Mandal: *Mechanical alloying and properties of immiscible Cu-20 wt.% Mo alloy*. Journal of Alloys and Compounds - 647 (2015) 1040-1047.

Conference Proceedings

Bhawesh Chhajed, Sudharm Rathore, Avanish Kumar, Aparna Singh: *Investigation of microstructural evolution in nano-structured bainite during Paris law regime of fatigue crack growth*. European Conference on Fracture 2024.

Avanish Kumar, Aparna Singh: *The role of microstructure on damage tolerance in nano-bainitic steels.* 1st Virtual European Conference on Fracture (VECF1), Structural Integrity Procedia, 28 (2020) 93–100.

Avanish Kumar, Aparna Singh: *Improvement of strength-toughness combination in nanostructured bainite*. ECF22 - Loading and Environmental effects on Structural Integrity; Belgrade, Serbia, Structural Integrity Procedia, 13 (2018) 548–553.

Avanish Kumar, Aparna Singh: *Bainitic steels: Strength as a function of carbon concentration*. Asia Steel International Conference, 02/2018, Bhubaneswar, India.

Avanish Kumar, K. Jayasankar, M. Debata, A. Mandal: *Development of Cu-Mo alloy for high power microwave devices,* 26th AGM Materials Research Society of India (MRSI), Theme Symposium "Materials for Inclusive Development", 02/2015, Jaipur, India.