

Dr. SASWATA BHATTACHARYA

Associate Professor,
Department of Materials Science and Metallurgical Engineering,
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Institution: IIT Hyderabad (Indian Institute of Technology Hyderabad)

EDUCATION (Academic Qualification)

Doctor of Philosophy (Materials Engineering, 2008)

Awarded by Faculty of Engineering, Indian Institute of Science, Bangalore 560012, INDIA. Thesis: Evolution of Multivariant Microstructures with Anisotropic Misfit: A Phase Field Study

Master of Science (Eng.) (Metallurgy, 2002)

Awarded by Faculty of Engineering, Indian Institute of Science, Bangalore 560012, INDIA. Thesis: Ternary Spinodal Decomposition: Effect of Interfacial Energy

Bachelor of Technology (Ceramic Technology, 1999)

Awarded by Government College of Engineering and Ceramic Technology, Calcutta University, Kolkata-700010, West Bengal, INDIA, First class with honors.

PROFESSIONAL EXPERIENCE	
Assistant Professor Department of Materials Science and Metallurgical Engineering	July 2013 - January 2019
Materials Scientist Materials Modeling and Tribology Lab General Electric (GE) India Technology Center Bangalore - 560066, INDIA	September 2011 - June 2013
Post-Doctoral Fellow Research Associate Department of Materials Science and Engineering Penn State University University Park, PA-16802, USA	July 2008 - July 2011 July 2011 - August 2011

RESEARCH INTERESTS

- Phase transformations in alloys and oxides, Phase-field modeling, Discrete dislocation dynamics
- Integration of mesoscale models of microstructural evolution with deformation mechanics models (crystal plasticity, discrete dislocation dynamics, damage and fracture)
- Prediction of process-microstructure-property relations. Development and implementation of high-performance integrated computational materials engineering (ICME) tools for materials design

EXPERTISE

Computational modeling of phase transformations in materials

- Development of phase-field models of microstructural evolution in alloys and oxides and their numerical implementation
- Discrete dislocation dynamics simulations of plasticity and creep, computational crystal plasticity models of deformation
- HPC skills: OpenMP, MPI and GPU-based methods

LIST OF PUBLICATIONS

Journals

1. “Interfacial dislocation network in precipitation strengthened alloys during creep: a discrete dislocation dynamics (DDD) study in three dimensions”, T. Jogi and Saswata Bhattacharya, *Modell. And Simul. In Mater. Sci. and Eng.*, 29, 035010, 2021
2. “Phase field modeling of fracture in Quasi-Brittle materials using natural neighbor Galerkin method”, P. Kasirajan, **S. Bhattacharya**, A. Rajagopal, J N Reddy, *Comp. Methods in Appl. Mech. And Eng.*, 366, 113019, 2020
3. “Back-Stress and Its Evolution during Primary Creep in Particle Strengthened Nickel Superalloys”, Sanket Sarkar, Yan Gao, Shenyan Huang, **Saswata Bhattacharya**, Swapnil Patil, Ramkumar Oruganti, *Crystals*, 10(4), 306, 2020
4. “A phase-field study of elastic stress effects on phase separation in ternary alloys”, Sandeep Sugathan, **Saswata Bhattacharya**, *Computational Materials Science*, 172(1), 109284, 2020
5. “Tunable polarization components and electric field induced crystallization in polyvinylidene fluoride: A piezo polymer”, Ronit Ganguly, Soumya Bandyopadhyay, Kumaraswamy Miriyala, Vijayabhaskar Gunasekaran, **Saswata Bhattacharya**, Amit Acharyya, Ranjith Ramadurai, *Polymer Crystallization*, 2(1), e10027, 2019
6. “Realization of rhombohedral, mixed, and tetragonal like phases of BiFeO₃ and ferroelectric domain engineering using a strain tuning layer on LaAlO₃(001) substrate”, MM Sajmohan, Soumya Bandyopadhyay, Tushar Jogi, **Saswata Bhattacharya**, R. Ramadurai, *Journal of Applied Physics*, 125(1), 012501, 2019.
7. “Phase-Field Modelling of Evolution of Compact Ordered Precipitates in Ternary Alloy Systems”, Sandeep Sugathan, **Saswata Bhattacharya**, *MRS Advances*, 4 (25-26), 1457-1463, 2019
8. “Low temperature synthesis and characterization of single phase multi-component fluorite oxide nanoparticle sols”, M. Anandkumar, **Saswata Bhattacharya**, A S Deshpande, *RSC Advances*, 9, 26825-26830, 2019
9. “Enhancing elevated temperature strength of copper containing aluminium alloys by forming L12Al3Zr precipitates and nucleating θ 00 precipitates on them”, Surendra Kumar Makineni, Sandeep Sugathan, Subhashish Meher, Rajarshi Banerjee, **Saswata Bhattacharya**, Subodh Kumar, Kamanio Chattopadhyay, *Scientific Reports*, 7(1), 11154, 2017
10. “A phase-field study of domain dynamics in ferroelectric BCT-BZT system”, Soumya Bandyopadhyay, Tushar Jogi, Kumaraswamy Miriyala, Ranjith Ramadurai, and **Saswata Bhattacharya**, *MRS Advances*, 2016, available on CJO2016. doi:10.1557/adv.2016.384.
11. “Phase-field modeling of electrochemical phenomena”, **Saswata Bhattacharya**, Soumya Bandyopadhyay, Abhik Choudhury, *Journal of the Indian Institute of Science* 96.3 (2016): 257-268.

12. "Anisotropic Li intercalation in Li_xFePO_4 nano-particle: a spectral smoothed boundary phase-field model", L Hong, L Liang, **S Bhattacharyya**, W Xing, L -Q Chen, *Physical Chemistry Chemical Physics*, 18, 9537, 2016.
13. "Evolution of Interfacial Dislocation Networks in Particle-Strengthened Alloy Systems During High Temperature Creep: A Discrete Dislocation Dynamics Study", Tushar Jogi and **Saswata Bhattacharyya**, *Transactions of the Indian Institute of Metals*, 69, 507, 2016.
14. "An integrated fast Fourier transform based phase-field and crystal plasticity approach to model recrystallization of three dimensional polycrystals", L Chen, J Chen, RA Lebensohn, YZ Ji, TW Heo, **S Bhattacharyya**, K Chang, S Mathaudhu, ZK Liu, L-Q Chen, *Computer Methods in Applied Mechanics and Engineering*, 285, 829, 2015.
15. "Effect of epitaxial strain on phase separation in thin films", A Lahiri, TA Abinandanan, MP Gururajan, **S Bhattacharyya**, *Philosophical Magazine Letters*, 94, 702, 2014.
16. "Role of polaron hopping in leakage current behavior of a SrTiO_3 single crystal", Y Cao, **S Bhattacharyya**, J Shen, CA Randall, L-Q Chen, *Journal of Applied Physics*, 114, 224102, 2013
17. "A phase-field model for elastically anisotropic polycrystalline binary solid solutions", Tae Wook Heo, **Saswata Bhattacharyya** and Long-Qing Chen, *Philosophical Magazine*, 93, 1468, 2013.
18. "Nonlinear phase-field model for electrode-electrolyte interface evolution", Linyun Liang, Yue Qi, Fei Xue, **Saswata Bhattacharyya**, Stephen J Harris, and Long-Qing Chen, *Physical Review E*, 86, 051609, 2012.
19. "Effective elastic properties of polycrystals based on phase-field description", G. Sheng, **S Bhattacharyya**, H. Zhang, K. Chang, S. L. Shang, S. N. Mathaudhu, Z. K. Liu and L.Q. Chen, *Materials Science and Engineering: A*, 554, 67, 2012.
20. "Elastic solutions with arbitrary elastic inhomogeneity and anisotropy", J.J. Wang, **Saswata Bhattacharyya**, Q. Li, T. W. Heo, X. Q. Ma and L. Q. Chen, *Philosophical Magazine Letters*, 92, 327, 2012.
21. "A Spectral Iterative Method for the Computation of Effective Properties of Elastically Inhomogeneous Polycrystals", **Saswata Bhattacharyya**, T. W. Heo, K. Chang, and L. Q. Chen, *Communications in Computational Physics*, 11(3), 726, 2012.
22. "A phase-field study of strain energy effects on solute-grain boundary interactions", T. W. Heo, **Saswata Bhattacharyya** and L. Q. Chen, *Acta Materialia*, 59(20), 7800, 2011.
23. "A phase-field model of stress effect on grain boundary migration", **Saswata Bhattacharyya**, T. W. Heo, K. Chang and L. Q. Chen, *Modelling and Simulation in Materials Science and Engineering*, 19(3), 035002, 2011.
24. "Exploring Topological Defects in Epitaxial BiFeO_3 Thin Films", R. K. Vasudevan, Y. C. Chen, H. H. Tai, N. Balke, P. P. Wu, **Saswata Bhattacharyya**, L. Q. Chen, Y. H. Chu, I. N. Lin, S. V. Kalinin, V. Nagarajan, *ACS Nano*, 5(2), 879, 2011.
25. "Watching domains grow: In-situ studies of polarization switching by combined scanning probe and scanning transmission electron microscopy", H. J. Chang, S. V. Kalinin, S. Yang, P. Yu, **Saswata Bhattacharyya**, P. P. Wu, N. Balke, S. Jesse, L. Q. Chen, R. Ramesh, S. J. Pennycook, A. Y. Borisevich, *Journal of Applied Physics*, 110(5), 052014, 2011.
26. "A phase-field model for deformation twinning", Tae Wook Heo, Yi Wang, **Saswata Bhattacharyya**, Xin Sun, Shenyang Hu, Long-Qing Chen, *Philosophical Magazine Letters*, 91, 110, 2011.
27. "Correlated polarization switching in the proximity of a 180 domain wall", Vasudeva Rao Aravind, A. N. Morozovska, **Saswata Bhattacharyya**, D. Lee, S. Jesse, I. Grinberg, Y. L. Li, S. Choudhury, P. Wu,

- K. Seal, A. M. Rappe, S. V. Svechnikov, E. A. Eliseev, S. R. Phillpot, L.Q. Chen, Venkatraman Gopalan and S. V. Kalinin, *Physical Review B*, 82, 0241111, 2010.
28. Evolution of multivariant microstructures with anisotropic misfit: A phase field study”, *Saswata Bhattacharyya* and T. A. Abinandanan, *Acta Materialia*, 57, 646, 2009.
 29. “Flow kinetics in porous ceramics: Understanding with non-uniform capillary models”, Debdutt Patro, *Saswata Bhattacharyya* and Vikram Jayaram, *Journal of the American Ceramic Society*, 90, 3040, 2007.
 30. “Phase separating bulk metallic glass: A hierarchical composite”, Byung Joo Park, Hye Jung Chang, Do Hyang Kim, Won Tae Kim, Kamanio Chattopadhyay, T. A. Abinandanan and *Saswata Bhattacharyya*, *Physical Review Letters*, 96, 245503, 2006.
 31. “A study of phase separation in ternary alloys”, *Saswata Bhattacharyya* and T. A. Abinandanan, *Bulletin of Materials Science*, 26, 193, 2003.

Selected Conference Proceedings

1. “Numerical Simulation of Grain Growth by Phase Field Method: An Efficient Algorithm”, A. K. Verma, A. R. Chintla, P. Ghosh, S. Chandra, Sandeep Sugathan and *Saswata Bhattacharya*, Thermo-Mechanical Simulation and Processing of Steels SimPro 2016, Steel Authority of India Limited, RDCIS, Ranchi, Publishers: Viva Books Private Ltd, ISBN 9789385919862.
2. “Phase-field model of diffusional phase transformations in elastically inhomogeneous polycrystals”, Tae Wook Heo, *Saswata Bhattacharyya* and Long-Qing Chen, *Solid State Phenomena*, 172-174, 2011, pp. 1084 - 1089.
3. “A Monte Carlo study of interfacial properties of phase separating alloys”, *Saswata Bhattacharyya*, Ferdinand Haider and T. A. Abinandanan, *Proceedings of an International Conference on Solid-Solid Phase Transformations in Inorganic Materials 2005*, v 2, 2005, pp. 705 – 714.

TEACHING EXPERIENCE (Courses taught)

- Computational Methods in Materials Science
- Thermodynamics and Kinetics of Materials
- Metallic Materials
- Introduction to Micromechanics of Solids
- Rate Phenomena in Process Modelling
- Machine Learning and Data Analytics in Materials Science

Training courses and workshops

1. Certificate course on “Micromechanics: fundamental concepts and applications in the study of microstructural evolution” at TATA Steel
2. NRC-M Lectures on Phase-field modeling and its applications" at IISc, Bangalore
3. NRC-M Lecture on Examples of phase-field modeling in ICME" at IISc, Bangalore

Ph.D. Thesis Guided

Sandeep Sugathan

Thesis Title: A Phase-Field Study of Elastic Stress Effects on Phase Separation in Ternary Alloy Systems

M. Tech. Thesis Guided

G. S. Bharathi Ganesh - Thesis Title: Phase-Field Modeling of Eutectoid Transformation in Fe-C alloy (2017)

Rahul Kumar Saini - Thesis Title: The effect of concentration-dependent degenerate mobility on spinodal decomposition in binary alloys (2018)

Completed Sponsored/Consultancy Projects

1. Dislocation Dynamics based studies in Particle Strengthened Alloy Systems", Funded by General Electric India Technology Centre, JFWTC, 2014-2016, INR 14 Lakhs.
2. Phase field modeling of eutectoid transformation in steels", Funded by TATA Steel Limited, 2015-2016, INR 13 Lakhs.
3. Development of Modeling Techniques (Atomistic Monte Carlo and Phase-field simulations) to understand metallurgical phenomena in advanced high strength steels", TATA Steel Limited, November 2016-2019, INR 30 Lakhs.
4. Computational Microstructural Design of P/M Disk Superalloys using Phase Field Modeling towards Accelerated Alloy Design", DRDO-DMRL, 2017-2020, INR 34 Lakhs.
5. Accelerated Alloy Design and Processing Optimization Using Computational Thermodynamics and Kinetics - Based Tools", Mishra Dhatu Nigam Limited (MIDHANI), 2017 – 2020; INR 63 Lakhs
6. Effect of Electromechanical Forces on Domain Evolution in Ferroelectric and Multiferroic Thin Films: Phase-Field Modeling and Simulations", DST-SERB (EMR), August 2017 - August 2020, INR 54.84 Lakhs

Books/Reports/Chapters/General Articles:

Saswata Bhattacharyya, Soumya Bandyopadhyay and Abhik Choudhury, Invited review article on "Phase-Field Modeling of Electrochemical Phenomena" in Journal of the Indian Institute of Science, Vol. 96(3) Jul. – Sep. 2016