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Engineering & Scientific Consulting

Matthew Bowers, Ph.D., P.E.

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Professional Profile

Dr. Bowers specializes in failure analysis, failure prevention, metallurgy, materials science, component life prediction, and engineering risk assessment. He has experience in the medical device, utility, oil and gas, automotive, and consumer electronics/products industries.

While at Exponent, Dr. Bowers has leveraged his technical skills and experience to address a wide variety of client challenges, including failure analysis and root cause investigations, materials selection and process development, medical device regulatory testing and validation, failure mode and effects analysis (FMEA), reliability testing, and utility asset management and condition assessment. He has particular interest in assessing the fracture and fatigue behavior of metallic components and the microstructure-property relationship in materials using techniques such as optical and scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), computed tomography (CT), micro/nanoindentation testing, analytical modeling, and novel mechanical testing methods. Dr. Bowers takes full advantage of Exponent's technical breadth by assembling diverse, multidisciplinary teams to solve complex problems.

Prior to joining Exponent, Dr. Bowers worked as a postdoctoral fellow at Lawrence Berkeley National Lab, where he studied the thermally and mechanically activated mechanisms of grain boundary migration in face-centered cubic (FCC) metals at the atomic scale. Dr. Bowers completed his Ph.D. research at The Ohio State University in 2014, where he studied the deformation mechanisms and origins of functional fatigue in NiTi-based (Nitinol) shape memory alloys (SMAs) as part of a large research effort involving multiple government agencies and industry partners.

Additionally, Dr. Bowers has authored several technical publications and book chapters, has served as a teaching assistant for undergraduate engineers, and has presented his work at academic and industrial conferences.

Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, The Ohio State University, 2014

M.S., Materials Science and Engineering, The Ohio State University, 2011

B.S., Engineering Physics, John Carroll University, 2009

Licenses and Certifications

Professional Engineer Metallurgical, California, #2003

Professional Engineer, Maryland, #58351

Professional Affiliations

ASTM International

The Minerals, Metals, and Materials Society—TMS

Publications

Georgin B, Bowers M, Hudgins A, Chy H, Luy A, Testing the Effectiveness of Covered Conductors for Wildfire Mitigation, CIGRE Conference Paper: Paris Session, August 25-30 2024, B2 PS3, Paper 10327.

Malito, L.G., Briant, P.L., Bowers, M.L., Easley, S., Schaffer, J.E. and James, B., 2022. Fatigue, Fracture, and Crack Arrest from Bending Induced Pre-strain in Superelastic Nitinol. Shape Memory and Superelasticity, pp.1-13

Bowers ML, Ophus C, Gautam A, Lancon F, Dahmen U. Step coalescence by collective motion at an incommensurate grain boundary. Physical Review Letters 2016; 116(1):106102.

Bowers ML, Gao Y, Yang L, Gaydosh DJ, De Graef M, Noebe RD, Wang Y, Mills MJ. Austenite grain refinement during load-biased thermal cycling of a Ni49.9 Ti50.1 shape memory alloy. Acta Materialia 2015; 91:318-329.

Kwon J, Bowers ML, Brandes MC, McCreary V, Robertson IM, Sudaharshan Phani P, Bei H, Gao YF, Pharr GM, George EP, Mills MJ. Characterization of dislocation structures and deformation mechanisms in as-grown and deformed directionally solidified NiAl-Mo composites. Acta Materiala 2015; 89:315-326.

Bowers ML, Chen X, De Graef M, Anderson PM, Mills MJ. Characterization and modeling of defects generated in pseudoelastically deformed NiTi microcrystals. Scripta Materialia 2014; 78:69-72.

Selected Presentations

M.L. Bowers, B. James, ‘Case Studies on Sterilization-Induced Embrittlement in Metallic Medical Devices,' MS&T Annual Meeting, Columbus, OH, 2018.

M.L. Bowers, P. Briant, B. James, P. Adler, ‘Nitinol fatigue life prediction based on inclusion content and stressed volume,' ASTM Fourth Symposium on Fatigue and Fracture of Metallic Medical Materials and Devices, San Diego, CA, 2018.

Bowers ML, Gautam A, Ophus C, Lançon F, Dahmen U. Dynamic observation of step nucleation and propagation at grain boundaries. TMS Annual Meeting, Nashville, TN, 2016.

Bowers ML, Chen X, Anderson PM, Mills MJ. Characterization and modeling of transformation-induced defects in pseudoelastically-deformed NiTi microcrystals. Shape Memory and Superelastic Technologies (SMST) Annual Meeting, Pacific Grove, CA, 2014.

Bowers ML. Insights into transformation-induced defect generation in NiTi shape memory alloys. Invited seminar, Los Alamos National Laboratory, Los Alamos, NM, 2014.

Bowers ML. Insights into transformation-induced defect generation in NiTi shape memory alloys. Invited seminar, Lawrence Berkeley National Laboratory, Berkeley, CA, 2014.

Bowers ML, Yang L, De Graef M, Anderson PM, Mills MJ. Microstructural evolution in NiTi polycrystals strained by load biased thermal cycling. TMS Annual Meeting, San Diego, CA, 2014.

Bowers ML, Yang L, T. Nuhfer, De Graef M, and Mills MJ. In-situ and post-mortem observations of microstructural evolution in NiTi polycrystals strained by load-biased thermal cycling. Microscopy and Microanalysis Annual Meeting, Indianapolis, IN, 2013.

Bowers M, Chen X, Yang L, Manchiraju S, Sarosi P, Noebe RD, Anderson PM, Mills MJ. STEM characterization of defects generated during the martensitic transformation in NiTi shape memory alloys. Microscopy and Microanalysis Annual Meeting, Phoenix, AZ, 2012.

Bowers M, Manchiraju S, Uchic M, Sarosi P, Anderson PM, Mills MJ. Characterization of defects generated during the martensitic transformation in pseudoelastically-deformed NiTi microcrystals. MS&T Annual Meeting, Columbus, OH, 2011.

Bowers M, Norfleet D, Uchic M, Manchiraju S, Sarosi P, Anderson PM, Mills MJ. Size effects in the pseudoelastic deformation in NiTi microcrystals. TMS Annual Meeting, San Diego, CA, 2011.

Book Chapters

Malito LG, Bowers ML, Briant P, Ganot GS, James B. Fractography of Nitinol. ASM Metals Handbook Volume 12. 2024; 430-440

Bowers, M, Ganot, G, Malito, L, Kondori, B, Anyanwu, E, Svedlund, F, James, B, “Failure Analysis of Medical Devices,” Analysis and Prevention of Component and Equipment Failures. ASM Handbook, Volume 11A, ASM International, 2021, p. 736 – 753