Exponent®
Engineering & Scientific Consulting


# David Marshall

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## Professional Profile

David Marshall is a metallurgical engineer that specializes in failure analysis, materials characterization, and understanding the connection between processing, microstructural development, and mechanical properties of metals. His graduate research experience includes thermomechanical simulation of weld heat-affected zone microstructures made in automotive steels, with subsequent characterization performed using advanced techniques such as dilatometry, scanning electron microscopy (SEM), transmission electron microscopy (TEM), transmission Kikuchi diffraction (TKD), and focused ion beam (FIB) preparation of TEM samples. Mr. Marshall also has practical technical experience with specimen fabrication, specimen heat treatment for microstructural development, and test method development for mechanical characterization. Mr. Marshall's graduate coursework included a strong background in physical metallurgy, with courses covering the analysis of metallurgical failures, the various deformation processes for plastic forming of metals, and the solidification of metals during industrial applications

Prior to joining Exponent, Mr. Marshall conducted his MS and PhD research in the Advanced Steel Processing and Products Research Center (ASPPRC) at the Colorado School of Mines. In his graduate research, Mr. Marshall investigated the microstructural evolution and mechanical property improvements of spot welds made in next-generation automotive steels during a low temperature baking treatment. He developed methods for accurately replicating spot weld microstructures for isolated characterization of the weld heat-affected zone and implemented test methods not conventionally used in the mechanical characterization of spot welds to offer new insights on weld microstructural characterization. He examined fine-scale microstructural evolution using electron diffraction in the TEM coupled with 3D atom probe tomography to measure local solute distributions in the weld microstructures. As a graduate researcher, Mr. Marshall also served in a leadership role as the Student Representative for the ASPPRC.

While obtaining a BS in Materials Science and Engineering from The Ohio State University, Mr. Marshall gained practical industry experience during several internships, including: working in a steel company metallurgical quality lab; redesigning welded vehicle suspension components; synthesizing hydrogels for controlled drug delivery; and conducting mechanical property evolution research on metal stampings, extrusions, and castings during the various stages of the automotive manufacturing process.

## Academic Credentials & Professional Honors

Ph.D., Metallurgical and Materials Engineering, Colorado School of Mines, 2024

M.S., Metallurgical and Materials Engineering, Colorado School of Mines, 2021

B.S., Materials Science and Engineering, Ohio State University, 2018

 

## Prior Experience

Graduate Researcher, Colorado School of Mines, 2019-2024

Graduate Teaching Assistant, Colorado School of Mines, 2019-2023

Metallurgical Engineering Intern, General Motors, 2018-2019

## Publications

D. Marshall, C. Schenck, L. Hines, and J. Speer, “Solute Enrichment in the Fusion Zone During Resistance Spot Welding of a Third Generation Advanced High Strength Steel,” Key Engineering Materials, vol. 966, pp. 55-62, 2023.

C.J. Rietema, M.R. Chancey, S.K. Ullrich, C.B. Finfrock, D.V. Marshall, B.P. Eftink, Y.Q. Wang, G.R. Bourne, S.A. Maloy, A.J. Clarke, and K.D. Clarke, “The Influence of Nitrogen and Nitrides on the Structure and Properties of Proton Irradiated Ferritic/Martensitic Steel,” Journal of Nuclear Materials, vol. 561, 2022.

D. Marshall, D. Bhattacharya, and J. Speer, “Influence of Paint Baking on the Energy Absorption and Failure Mode of Resistance Spot Welds in TRIP1180 Steel,” Journal of Manufacturing Science and Engineering, Transactions of the ASME, vol. 143, no. 9, 2021.

**Presentations**

D. Marshall and J. Speer, “Investigation on the Paint Bake Effect in Resistance Spot Welds of Advanced High Strength Steels,” Semiannual Reports and Presentations for the ASPPRC Consortium Research Meetings, 2019-2024.

D. Marshall, C. Schenck, L. Hines, and J. Speer, “Solute Enrichment in the Fusion Zone During Resistance Spot Welding of a Third Generation Advanced High Strength Steel,” THERMEC International Conference on Processing & Manufacturing of Advanced Materials, Vienna, Austria, July 2 – 7, 2023.

D. Marshall and J. Speer, “Influence of Paint Baking on Microstructure and Mechanical Behavior of Resistance Spot Welds,” International Symposium on New Developments in Advanced High-Strength Sheet Steels, June 19 – 22, 2023.