



**Exponent**<sup>®</sup>  
Engineering & Scientific Consulting

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## Professional Profile

Dr. Stewart specializes in welding engineering, joining and heat-treating processes, metallurgy, failure analysis, non-destructive evaluation, and corrosion. He has extensive experience with a variety of analytical techniques including optical microscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM), and X-ray diffraction (XRD).

Dr. Stewart also has experience with computational modelling and simulation, specifically finite element analysis (FEA) of heat transfer in welding processes and modelling thermophysical properties of various alloys.

Prior to joining Exponent Dr. Stewart was a Graduate Research Associate at The Ohio State University, completing his Ph.D. in 2019. His doctoral thesis examined the impact of temper bead welding on the tempering response in Grade 22 steel, a 2.25Cr-1Mo steel used in oil & gas piping and nuclear power applications. Temper bead welding is a technique that utilizes heat input from the welding process to temper brittle microstructures that form in the heat-affected zone (HAZ) that would require a post-weld heat treatment (PWHT) to remedy.

Dr. Stewart developed a methodology for quantifying the tempering response in low alloy steels that allowed the hardness distribution in the HAZ to be predicted based on thermal history during the welding process. Additionally, a computational model that can predict thermal histories in the HAZ based on welding process parameters was developed, his model utilized an automated design of experiment (DoE) capability that allowed users to input a range of welding parameters and compare expected hardness distributions for each combination, producing an optimal procedure for the desired outcome.

Dr. Stewart has utilized several welding and weldability techniques throughout his career, including operation of the Gleeble thermal-mechanical simulator, robotic GTAW welding machines, thermocouple instrumentation and data collection, and weldability analysis of Ni-base alloys. In addition, he has experience with a variety of welding processes, including GTAW, GMAW, resistance welding, friction welding, and laser/electron beam welding. He has experience with weld procedure development and qualification for applications in aerospace, oil & gas, and nuclear power generation.

## Academic Credentials & Professional Honors

Ph.D., Welding Engineering, The Ohio State University, 2019

M.S., Welding Engineering, The Ohio State University, 2017

B.S., Welding Engineering, The Ohio State University, 2016

## Prior Experience

Graduate Research Associate, The Ohio State University, 2015-2019

Engineering Intern (Structures and Combustors), GE Aviation, Summer 2015

Engineering Intern (Joining and Heat Treatment), GE Aviation, Summer 2014

## Professional Affiliations

American Welding Society (AWS) D101 Committee on Procedure and Performance Qualification

AWS B2 Subcommittee on Chromium-Molybdenum Steel Piping

## Publications

Stewart, J., Alexandrov, B., "Quantification of the Tempering Response in the Heat-affected Zone of Low Alloy Steels Subjected to Temper Bead Welding", Journal of Materials Processing Technology, Vol. 66, June 2021, pp 325-340.

Colijn, H., Stewart, J., Alexandrov, B., "Analysis of Precipitates in the Base Metal and HAZ of a 2.25Cr-1Mo Steel", Microscopy and Microanalysis, Vol. 27 (S1), August 2021, pp 1562-1563.

Jang, E., Stewart, J., Luo, Y., Qu, S., "Tempering Efficiency Evaluation for Dissimilar Weld Overlays", ASME 2020 Pressure Vessels and Piping Conference, August 2020.

## Presentations

Stewart, J., "Temper Bead Welding for Weld Overlays", American Welding Society FABTECH Conference, Atlanta, GA, November 6-8, 2018.

Stewart, J., "Quantification of the Tempering Response in Grade 22 Steel for Temper Bead Welding Applications", Materials Science & Technology (MS&T) Conference, Columbus, OH, October 14-18, 2018.

Stewart, J., "Temper Bead Welding for Dissimilar Metal Overlays in Power Generation, Oil & Gas, and Petrochemical Applications", Institute for Materials Research (IMR) Materials Week Conference, Columbus, OH, May 8-11, 2018

Stewart, J., "Temper Bead Welding for Weld Overlays", American Welding Society FABTECH Conference, Chicago, IL, November 6-9, 2017.

Stewart, J., "Single Sensor Differential Thermal Analysis (SSDTA) vs. Dilatometry Analysis for the Creation of Welding Continuous Cooling Transformation (CCT) Diagrams", Materials Science & Technology (MS&T) Conference, Pittsburgh, PA, October 8-12, 2017.

Stewart, J., "Temper Bead Welding for Weld Overlays", Welding and Repair Technology for Power Plants, 12th International EPRI Conference, Orlando, FL, June 21-23, 2017.

Stewart, J., "Temper Bead Welding for Dissimilar Metal Overlays in Power Generation, Oil & Gas, and Petrochemical Applications", Institute for Materials Research (IMR) Materials Week Conference, Columbus, OH, May 9-12, 2017