

## DANTE Solutions at Heat Treat 2021!



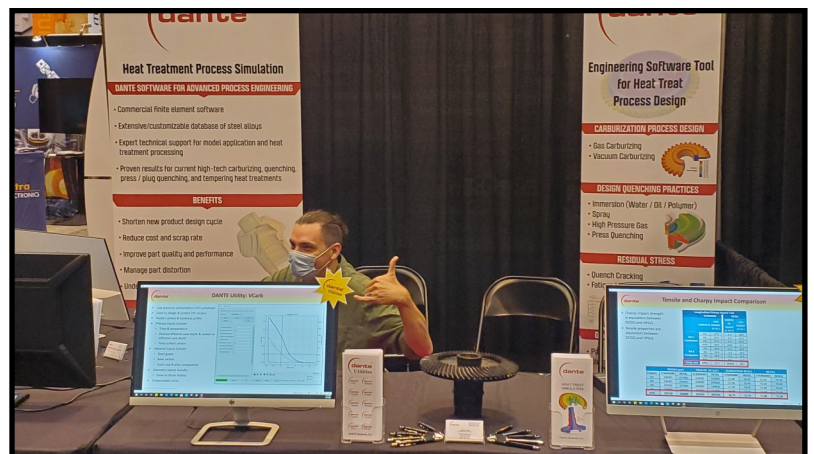
Heat Treating Society Conference and Exposition is the premier heat treating conference and exposition held biannually. The 31st installment, Heat Treat 2021, lived up to the hype, even if the current COVID-19 situation kept attendance low. Most of the DANTE team attended Heat Treat 2021 on October 14—16 2021 in St. Louis, MO to showcase our technology at the exposition and share our expertise in the technical sessions. Justin Sims and Jason Meyer each presented a technical paper, while Lynn and Justin each gave lectures for a class on material selection and heat treatment of gears. Stefan Habean also attended and spoke to many current and future DANTE customers at our booth. Jason also participated in the ASM Strong Bar competition. Read on to learn all the wonderful details!



Here we go! Lynn getting ready to welcome Heat Treat 2021 attendees to the DANTE booth on Day 1!



Justin letting everybody know DANTE is ready, willing, and able!

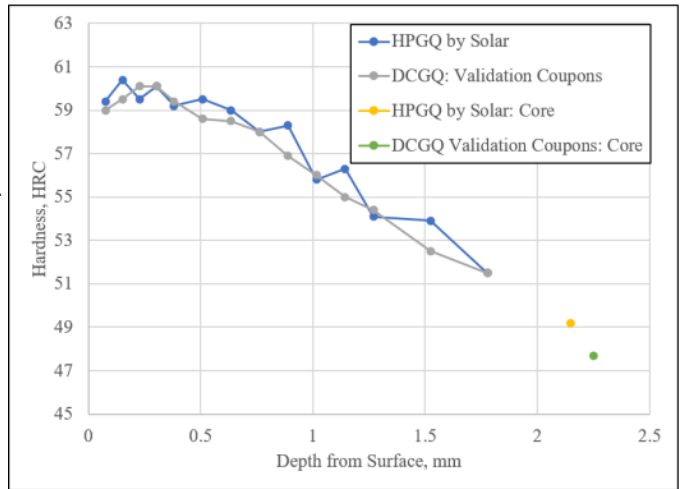


Jason hanging loose and letting everybody know DANTE is ready to rock Heat Treat 2021!

# Technical Session Highlights

## [Process to Minimize Distortion during High Pressure Gas Quenching Processes](#)

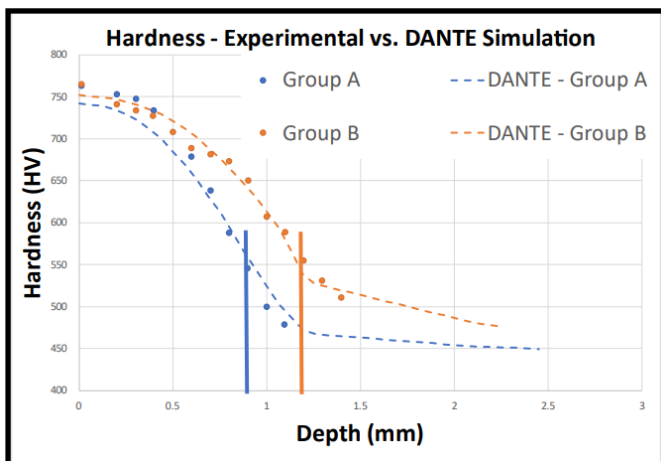
**Abstract:** A gas quenching method was developed by DANTE Solutions, in conjunction with the U.S. Army Combat Capabilities Development Command Aviation & Missile Center (DEVCOM AvMC), to control distortion in difficult to quench geometries. This new method addresses the non-uniform cooling inherent in most gas quenching processes. A prototype unit was constructed and tested with the aim of controlling the martensite formation rate uniformity in the component being quenched. With the ability of the DANTE Controlled Gas Quenching (DCGQ) unit to control the temperature of the quench gas entering the quench chamber, thermal and phase transformation gradients are significantly reduced. This reduction in gradients yields a more uniform phase transformation, resulting in reduced and predictable distortion. Being able to minimize and predict distortion during gas quenching, post heat treatment finishing operations can be reduced or eliminated, and as such, fatigue performance can be improved. This paper will discuss the prototype unit performance. Mechanical testing and metallographic analysis were also performed on Ferrium C64 alloy steel coupons and will be discussed. The results obtained showed that the slower cooling rate provided by the prototype did not alter the microstructure, hardness, strength, ductility, toughness, or residual stress of the alloy.



Axial Position	Coupon DCGQ 4 (mm)	Coupon DCGQ 5 (mm)	Coupon HPGQ 1 (mm)	Coupon HPGQ 2 (mm)
1	0.11	0.09	0.15	0.23
2	0.09	0.11	0.21	0.21
3	0.07	0.11	0.23	0.21
4	0.08	0.12	0.22	0.20
5	0.11	0.09	0.25	0.23
<b>AVERAGE</b>	<b>0.092</b>	<b>0.104</b>	<b>0.212</b>	<b>0.216</b>

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**Read the full paper here:** [Process to Minimize Distortion during High Pressure Gas Quenching Processes \(wsimg.com\)](http://wsimg.com)



## [Modeling the Effect of Chemistry Changes on Phase Transformation Timing, Hardness, and Distortion in Carburized 8620 Gear Steel](#)

**Abstract:** AISI 8620 low carbon steel is widely used due to its relatively low cost and excellent case hardening properties. The nominal chemistry of AISI 8620 can have a large range, affecting the phase transformation timing and final hardness of a carburized case. Different vendors and different heats of steel can have different chemistries under the same AISI 8620 range which will change the result of a well-established heat treatment process. Modeling the effects of alloy element variation can save countless

hours and scrap costs while providing assurance that mechanical requirements are met. The DANTE model was validated using data from a previous publication and was used to study the effect of chemistry variations on hardness and phase transformation timing. Finally, a model of high and low chemistries was executed to observe the changes in hardness, retained austenite and residual stress caused by alloy variation within the validated heat treatment process.

**Read the full paper here:** [Modeling the Effect of Chemistry Changes on Phase Transformation Timing, Hardness, and Distortion in Carburized 8620 Gear Steel. \(wsimg.com\)](http://wsimg.com)



## More News from HTS 2021

DANTE's Jason Meyer, along with Cleveland State University graduate student Brian Kohut, competed in ASM's Strong Bar competition. DANTE's Charlie Li acted as their advisor. The competition had students design a heat treatment for a 4140 bar that was then subjected to 3-point bending. The goal of the competition was to design a heat treatment which was able to withstand the highest load. Additional points were awarded for the coupon which underwent the most deflection.

Unfortunately, Jason and Brian chose to carburize their specimen, with the understanding that a 0.5 mm notch was going to be cut into the coupon prior to testing. The cutting never happened and the bars were tested as

treated. This led to a brittle failure in their coupon, since the surface carbon was designed to be 0.5 mm under the original surface. This meant the surface carbon tested was too high. Although they did not win, many valuable lessons were learned and they designed a wonderful poster to showcase their work.

Congratulations to the winners from Instituto Tecnológico De Morelia, Mexico, and all those who participated in the Strong Bar competition, and thanks to ASM International for organizing the competition and allowing students a taste of what it is like to design a steel's heat treatment for a specific application.

## Education Class: Material Selection and Heat Treatment of Gears

**Abstract from ASM:** Because of their unique contribution to the operation of so many machines and mechanical devices, gears have received special attention from the technical community for more than two millennia. New developments in gear technology, particularly from the materials and heat treatment perspectives, have improved gear performance. This course, developed jointly by the ASM Heat Treating Society and the AGMA, will provide an overview of materials selection and heat treatment of gears.

The course was divided in to several different sections, with experts from each field providing educational lectures on a particular topic. Lynn Ferguson and Justin Sims each taught sections involving heat treatment. Lynn taught the "Heat Treatment Principals and Processes II" and Induction Hardening" sections. These sections introduced participants to the many different heat treatment processes available for steel components and took an in-depth look at induction hardening. Justin lectured on the press quenching process. The "Press Quenching" section introduced participants to a general overview of the press quenching, with a focus on the process' influence on distortion. Several case studies were also shared to detail the nonintuitive nature of the distortion response to press quenching. Check out this [publication from DANTE](#) that shows how press quench loading can actually make distortion worse than free immersion quenching.

