DANTE Solutions at Heat Treat 2019!

Heat Treat 2019 is the premier heat treating conference and exposition held biannually. The entire DANTE team attended Heat Treat 2019 on October 15—17 2019 in Detroit, MI to showcase our technology at the exposition. Justin Sims, Charlie Li, and Lynn Ferguson presented technical papers during the technical sessions. Lynn and Charlie also each chaired a technical session. Stefan Habean and Dan Londrico (pictured at right), both Master students at Cleveland State University (CSU), as well as Jason Meyer, an undergraduate at CSU, presented a poster in the Fluxtrol Student Poster Competition. And so much more...

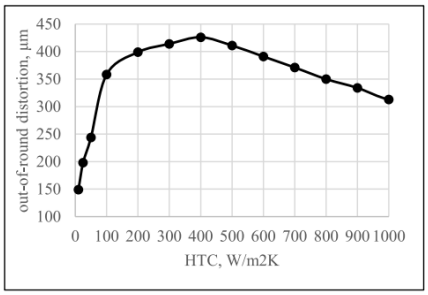
Justin Sims Receives Heat Treat Today's 40 Under 40 Award

Justin is an excellent analyst of steel heat treat processes. He is an expert modeler of quench hardening processes using the DANTE software, and he has trained many of the users in the company's list of licensees. More importantly, he has been a leader in development of the DANTE Controlled Gas Quenching process, with the first prototype installed at Akron Steel Treating for the purpose of minimizing part distortion while achieving required properties and performance.

Technical Session Highlights

Causes of Distortion during High Pressure Gas Quenching

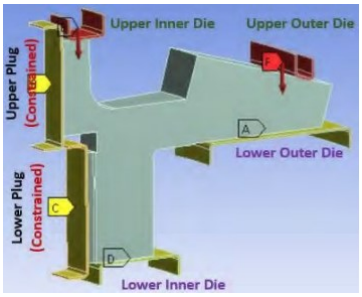
Abstract: Quench hardening is a necessary process for improving the mechanical and fatigue performance of load bearing steel components, but liquid quenching can lead to large distortions. High pressure gas quenching is becoming a more popular choice, with the assumption that a slower cooling rate will lead to less distortion. While true for certain geometries, nonlinearities in distortion response can make understanding the dimensional change of a component difficult due to the inherently complex behavior during quenching. Through the use of modeling, and a specially designed coupon, the out-of-round distortion of an eccentric bore is examined for common high-pressure gas quenching conditions. The causes of distortion are examined and explained using the model, with insights into why the cooling rate has a nonlinear relation with distortion.



Read the full paper here: https://img1.wsimg.com/blobby/go/e793bb6d-7bc3-472a-a860-2edb78c47e2b/downloads/Causes_of_Distortion_during_HPGQ_Process_of_St.pdf?ver=1571428713633

Distortion Minimization of Bevel Gear Press Quench Hardening Process Using Computer Modeling

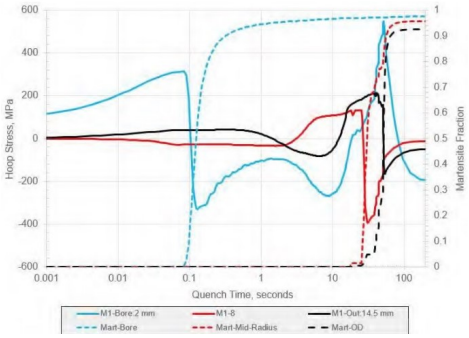
Abstract: Press quenching is used to harden gears with large sizes or thin-wall sections while keeping distortion under control. For carburized gears, controlling distortion is critical because only a limited amount of the carburized case can be machined off after hardening. In comparison to immersion oil quenching, the press quench process involves more process parameters due to the thermal and mechanical effects from the tooling on the parts. The press quench tooling and process designs are mainly experience based, with iterative trials needed before obtaining an acceptable process. Computer modeling provides a means for understanding the effects of the tooling and the process parameters on distortion, which can be used to optimize the process and tooling design.



Read the full paper here: https://img1.wsimg.com/blobby/go/e793bb6d-7bc3-472a-a860-2edb78c47e2b/downloads/Distortion_Minimization_of_Bevel_Gear_PQ_Harde.pdf?ver=1571428713690

Quenching Process Improvement Through Modeling

Abstract: Computer modeling offers an excellent method to investigate heat treatment processes, especially processes that have quality issues, that are open to use of different alloys, or that are under development. A recent presentation from Karlsruhe Institute of Technology was an excellent example of this, where three variations of a novel tube quenching process showed experimental evidence that two of the processes resulted in tubes with cracks on the bore while the third process produced crack-free parts. Interested in investigating this in more detail using computer modeling, a study was initiated to investigate additional process variations to better understand the effect of quenching conditions on stresses and microstructural evolution in the part. With a goal of producing martensite and residual compressive stress in the bore of a 4140 steel tube, a matrix of hardening processes was developed and executed. Models examined heat transfer and also microstructural evolution, i.e. phase transformation kinetics. Results showed that the timing and rate of martensite formation, and bainite kinetics had a significant effect on both the in-process stress state and the residual stress state.



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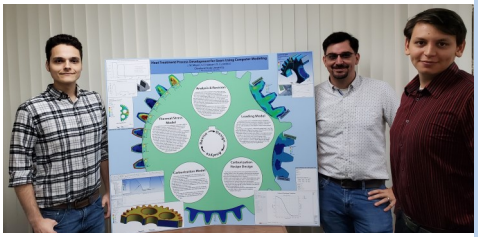
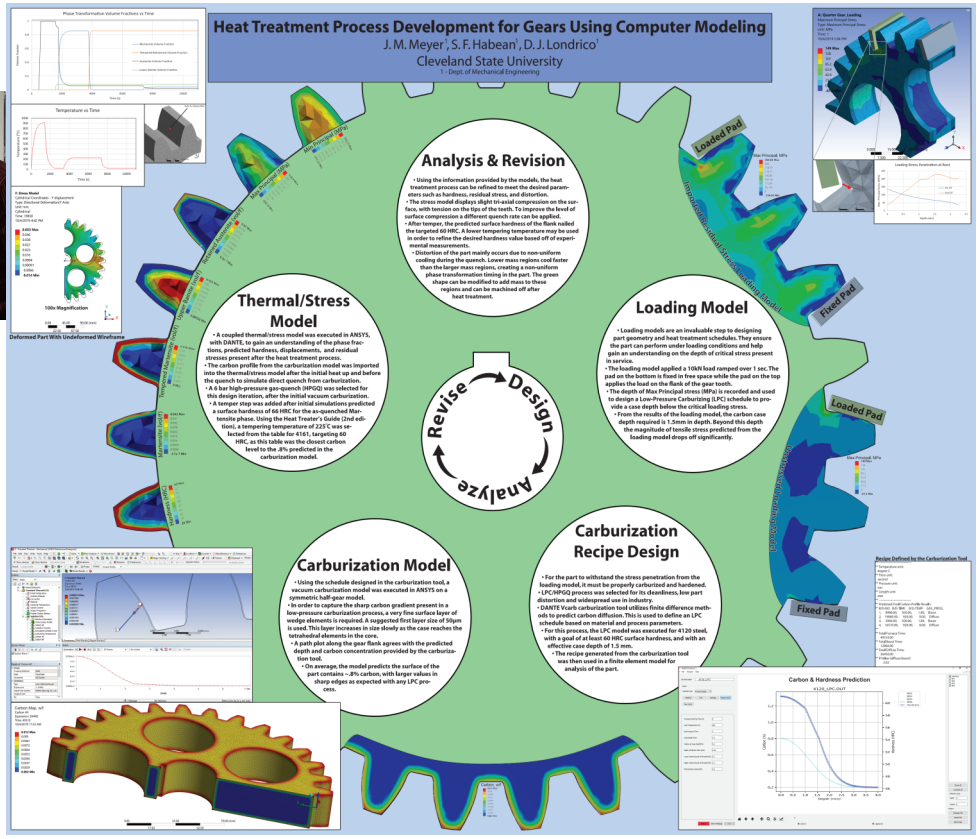
More News from HTS 2019

DANTE's newest team members, Dan (left) and Stefan (right), along with undergraduate student, Jason Meyer

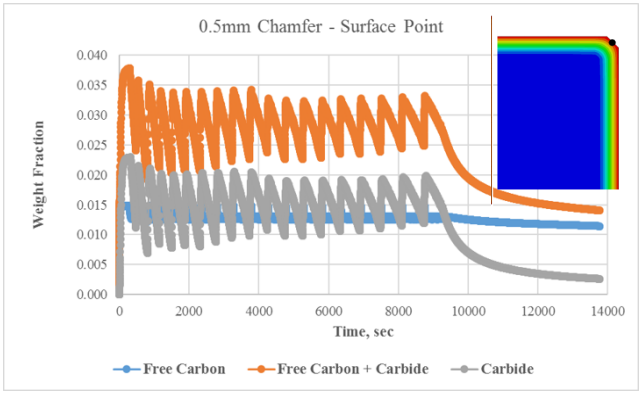


(middle), presented their poster, titled "Heat Treat Process Development for Gears using Computer Modeling." The poster highlighted how to use DANTE during the design of gears. This included determining the stress profile from the loading conditions. Then designing a low pressure carburization schedule, using DANTE's V-Carb software, to obtain the necessary case depth. Finally, ensuring the selected heat treatment provided proper residual stress and displacement profiles using DANTE. They did not win the competition, but they learned a lot about gear design and heat treatment, had the most innovative poster design, and had a good networking experience at HTS.



Advanced Materials & Processes and Gear Solutions Articles from DANTE

Technical articles by DANTE team members also appeared in the September edition of ASM's Advanced Materials and Processes, "Solving Critical Heat Treatment Challenges with Practical Process Modeling", and the October edition of Gear Solutions, "Using Simulation to Evaluate Part Green Shape to Reduce Distortion During Plug Quenching". Click on the links to view the complete articles.



The HT Pro article explores how DANTE can be used to design tooling for a press/plug quenching operations, including properly sizing a plug to replace the expander to get more consistent results. The article also shows how DANTE can be used to determine chamfer size during a low pressure carburizing process to avoid excessive carbide formation in the corner of the part, illustrated by the plot on the right.

The Gear Solutions' article examined using DANTE to determine the effects of a part's green shape on distortion of an inner spline during a plug quenching process. Several geometries were conceived for a bevel gear and the shape's effect on radial change and bow distortion was determined. The analysis showed that by adding mass near the spline helped to keep the radial growth to a minimum and also helped reduce the bow distortion.