Wishing Everyone Good Health

DANTE Solutions would like to wish everyone and their families health and well-being as the world continues to battle the COVID-19 pandemic. There is nothing more important during these troubling times than family. We would also like to thank all of the first responders and those on the front lines for their continued effort in helping to keep us safe and healthy.

We all need to be mindful of our neighbors and take care of each other during these trying times. DANTE Solutions has also been doing its part to help keep our employees, their families, and our community safe. We implemented a work from home policy for all DANTE employees that went into effect March 23rd. During that time, DANTE Solutions has remained open during normal business hours. We have continued to work on projects, support our customers, conduct DANTE training, and field new sales and consulting inquiries. We also offered existing customers temporary DANTE licenses to run the DANTE software on home computers.

Quick News:

- DANTE Solutions welcomes the following companies to its expanding user group:
  - **KITECH (Korea)**

- Justin Sims is part of the Focus Group overseeing a project titled "Nitriding and Ferritic Nitrocarburizing" being conducted at the Center for Heat Treat Excellence (CHTE) at Worcester Polytechnic Institute in Worcester, MA. The goal of the project is to form a fundamental understanding of the kinetics during a nitrocarburizing process through experimentation and data analysis. From this understanding, a finite difference model will be developed to predict the formation of nitrides, carbides, and nitrocarbides, and predict the diffusion of nitrogen and carbon. Optimal nitrocarburizing schedules can then be developed using simulation.

- Justin Sims contributed to several publications:

  - Heat Treat Modeling with Justin Sims: Heat Treat Radio episode, which aired on April 16th, discussing heat treatment modeling and what makes it a viable technology. Also discussed are the uses and benefits.

  - Process Innovation to Reduce Distortion During Gas Quenching: Article in Heat Treat Today: Aerospace Heat Treating edition (March 2020). The article discusses the results obtained from a study which evaluated the feasibility of using the DANTE Controlled Gas Quench (DCGQ) technology for hardening Ferrium C64. The results showed comparable microstructure and mechanical properties for coupons processed using DCGQ and the standard HPGQ process for C64. The DCGQ process uses controlled cooling to control the martensite transformation rate. The process significantly reduces distortion in difficult to quench geometries.

  - Simulation Tools to Effectively Calculate Process: Using Computer Modeling to Design Low Pressure Carburizing Schedules for Strong Carbide Forming Steel Alloys. This Metal Urgency column in Thermal Processing (February 2020) examines using DANTE heat treatment simulation software to design low pressure carburizing schedules for steels such as Pyrowear 675, Ferrium C64, Vasco X2, etc., which have the propensity to form large primary carbides during the carburization process.

  - Surface Stress is Key in Rolling Contact Fatigue: The Effects of Partial Decarburization on the Residual Stress Profile of a Through Hardened M50 and a Case Carburized M50NiL Bearing Ring. This Metal Urgency column in Thermal Processing (April 2020) examines the effect of minor decarburization on residual stress. Residual stress plays a critical role in rolling contact fatigue and must be evaluated to ensure consistent bearing life. DANTE heat treatment simulation software helps with this type of evaluation.

Software Highlights

NITRIDING MODELING AVAILABLE IN DANTE!
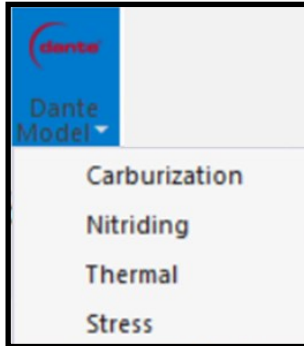
Need to design a nitriding process to achieve a certain overall case or white layer depth? Ever wonder how much compressive stress is imparted on the surface after a nitriding process? DANTE can now help with these questions and many more related to nitriding processes. That's right, nitride modeling has come to the DANTE heat treatment simulation software! The software is capable of modeling the gas nitriding process, either under standard pressure or low pressure. The model will predict the diffusion of nascent nitrogen, as well as predict the formation and dissolution of nitrides. This allows for the determination of overall case depth and white layer depth.
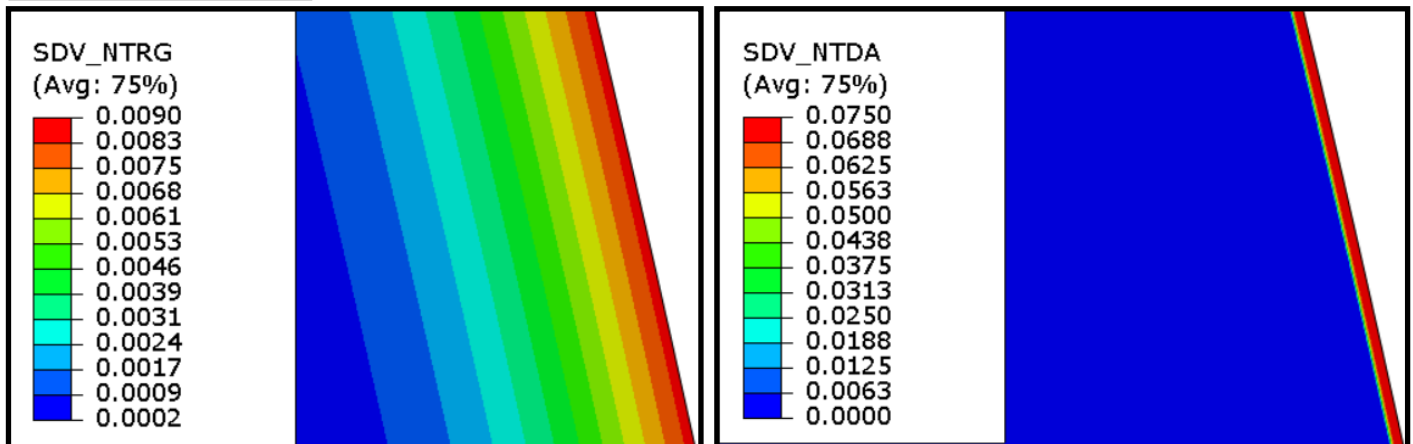
Nascent nitrogen, weight fraction

Nitrogen in nitride form, weight fraction

Future DANTE Software Improvements

DANTE 5.0 is on the horizon! Expected for release mid-2020, DANTE 5.0 will bring brand new capabilities to DANTE's state-of-the-art heat treatment simulation software. Planned for DANTE 5.0 is a carbide dissolution model, imbedded in the thermal and stress model. What this means for users is the ability to define an initial carbide size, either from experimental data of incoming material and determine how those carbides dissolve during the austenitizing process. The ability to model slight alloy variation from steel heat to heat will also be included. This capability will allow users to explore microstructural, stress, and distortion differences due to variations in alloy chemistry.

Since 1982 we have provided engineering services to the metalworking industries, and for over 30 years we have focused on thermal processing. Our range of services has expanded to include several software products, with our DANTE° software being the premier package in the world for modeling heat treatment of ferrous parts. In recognition of this, we re-branded ourselves as Dante Solutions, Inc. in January, 2014.

While we use computer analysis tools for most of our work, we are much more than analysts using computer software tools. Our staff includes experts in mechanical and metallurgical engineering. Let us help you improve your heat treatment and deformation processes, use new materials, and develop new products.

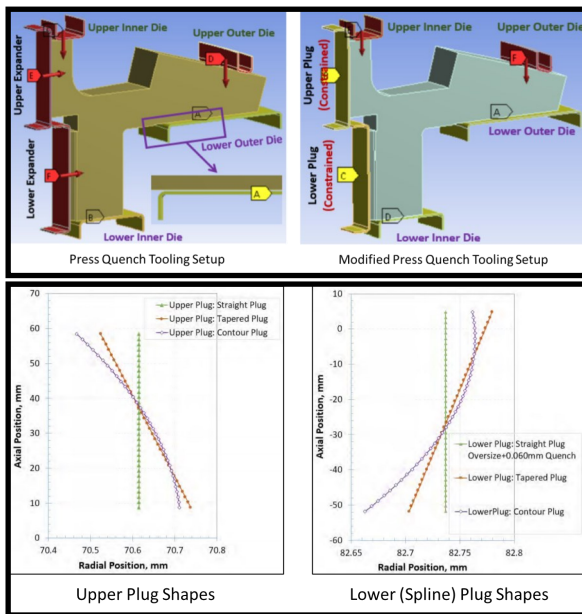For more information, contact us: support@dante-solutions.com

Project Highlights

Distortion Minimization of a Press Quenched Bevel Gear

Problem Statement:

- Excessive shrinkage of the bore during quenching

- Excessive taper of the bore during quenching

Project Objectives:

1. Determine the cause of the poor dimensional control

2. Reduce the shrinkage and taper to acceptable values

   - Shrinkage can usually be controlled by using a higher load on the expander or by using a plug instead of an internal expander

   - Taper can usually be corrected by using a tapered plug / expander

Press Quench Tooling Setup

Modified Press Quench Tooling Setup

Upper Plug Shapes

Lower (Spline) Plug Shapes

Results: Determining Cause of Distortion

- Figure below shows that a gear quenched without constraints and quenching using an expander yield approximately the same results

- This means the expander is ineffective in controlling the radial dimension of the bore

- Using a plug is more consistent than using a higher load due to the inner diameter shrinking to the same size each time
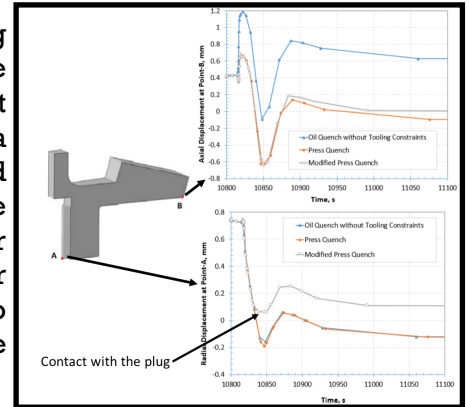
Results: Process Modification

- Using a straight plug reduced the radial shrinkage to acceptable levels, but had a large taper of the upper section of the bore

- Using a tapered plug corrected the taper to acceptable levels
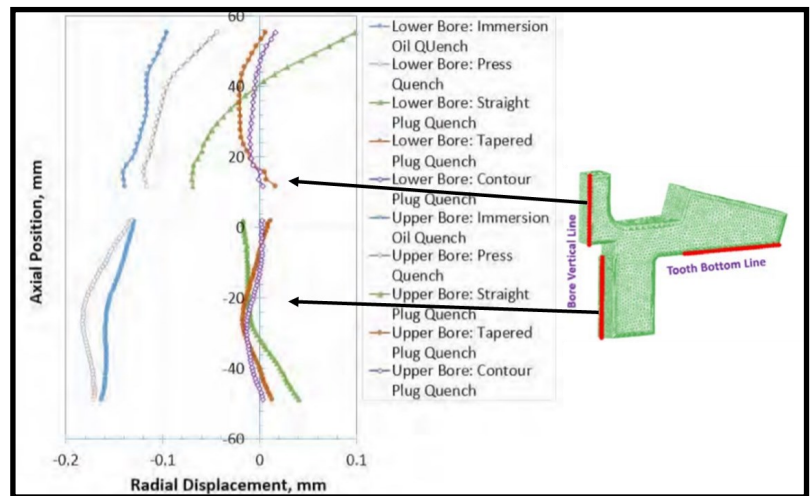
Conclusion

DANTE can be used to successfully model the press quenching process and determine causes of distortion from the process. For the process evaluated, the expander was not providing enough resistance to control the radial dimension of the bore. The DANTE model was then used to design and evaluate press quench tooling modifications with relative ease, saving time and money over trial and error experiments. For this case, a tapered plug was used to control the radial dimension and the taper of the bore.

One can view this, and many more aerospace case studies online at: **https://dante-solutions.com/aerospace**