



Quench and Temper of Steel Rolling Mill Roll

DANTE Solutions, Inc.

Problem Statement:

Quench and temper hardening of a large high speed steel rolling mill roll requires optimizing depth of hardening and in-process thermal gradients to maximize surface compression and minimize internal tensile stresses that increase likelihood of internal cracking.

Model was developed to determine optimal heat treatments for family of roll sizes.

Process Description:

Roll preheat, surface flash heating, spray quenching, and tempering are modeled with DANTE. Evolution of surface, subsurface and core stresses is tracked relative to thermal gradient and metallurgical phase evolution. Validated against physical measurements and metallurgical observation, the model can be used for new process development and as a QA tool.

Benefits:

Process trials can be conducted 'virtually' to optimize heat treating response.

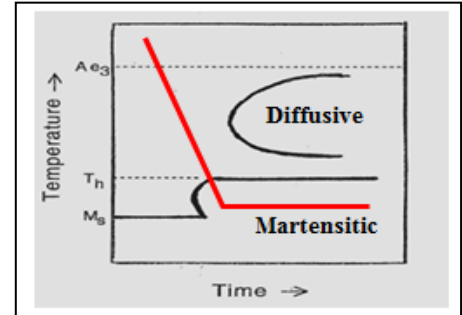
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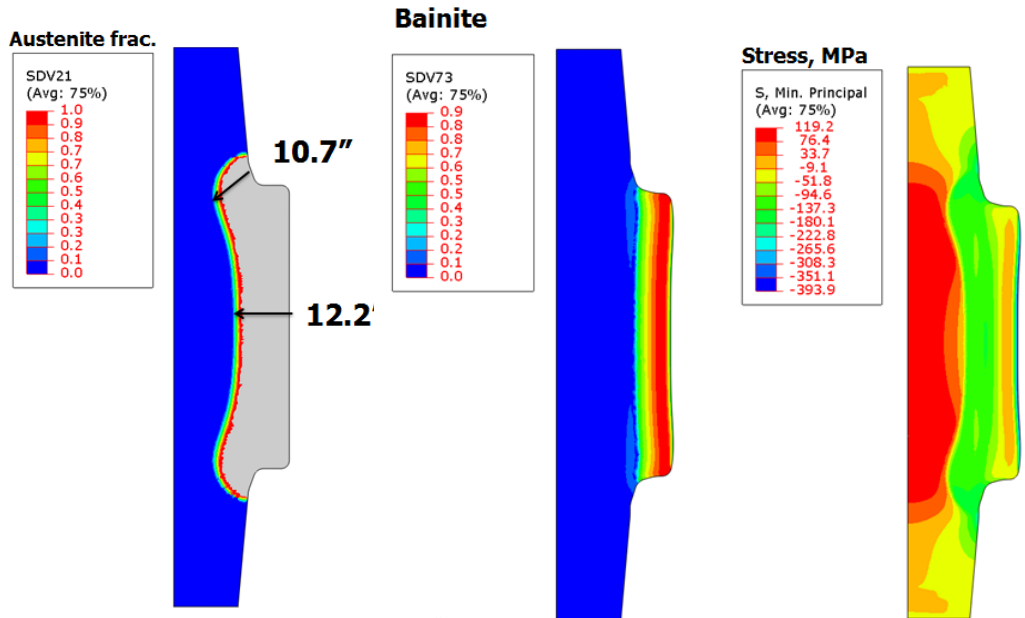
Website: www.dante-solutions.com



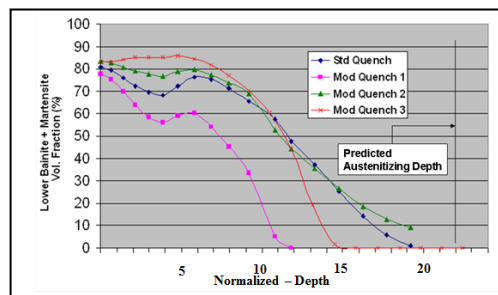
Differential hardening process applied to roll body provides a hardened, compressive surface layer



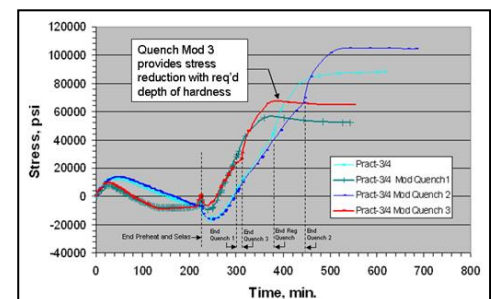
Steel metallurgical kinetics determines response to quench hardening heat treatment



DANTE predicts the depth of heating (austenitization), which impacts both surface hardening (depth of surface bainite layer), final surface compression, and the core tensile stress magnitude and distribution



Model used to predict practice which achieves maximum depth of hardness (bainite surface layer)



with minimal associated in-process and residual tensile stresses in the roll core