

GREAT DESIGNS IN STEEL

LASER HEAT TREATING OF AUTOMOTIVE DIES

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CONTENTS

- Fundamentals of Laser Heat Treating
- Process benefits
- Cost savings
- Advancements in Laser Heat Treating
 - Hot Stamping dies
 - Trim Dies
- Additive Manufacturing for tool and die
- Future work

LASER HEAT TREATING

Process:

Laser beam illuminates the surface of metal raising the temperature:

Stage 1: Austenite formation from pearlite-cementite (hypereutectoid steels) or from pearlite-ferrite (hypoeutectoid steels)

Stage 2: Martensite transformation from Austenite

- Cooling rates ($\sim 100^{\circ}\text{C}/\text{sec}$) > Critical cooling rates for martensite formation



PROCESS VIDEO

LASER HEAT TREATING

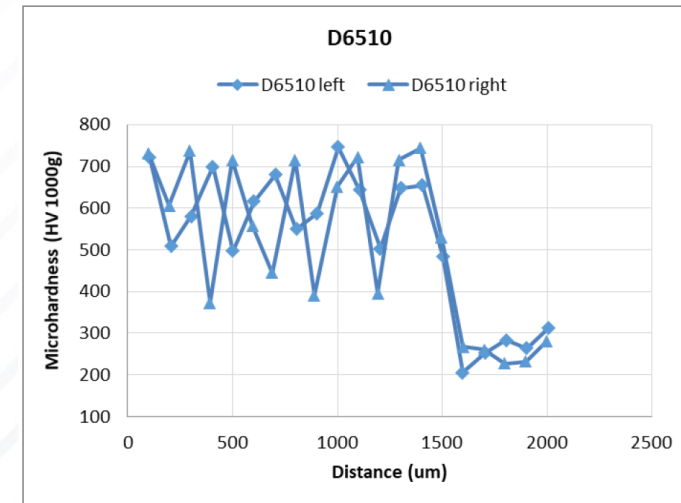
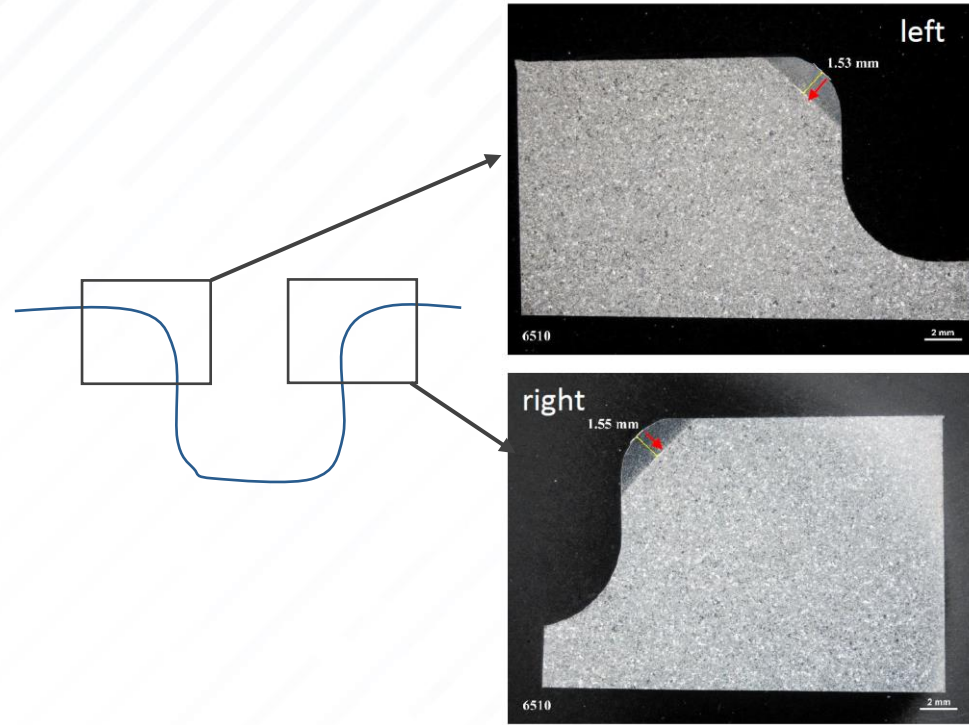
Heat Treatable Materials

+ Any material with 0.2% or higher C

- D6510
- 0050A
- A2
- D2
- S7
- G3500
- 4140 and others

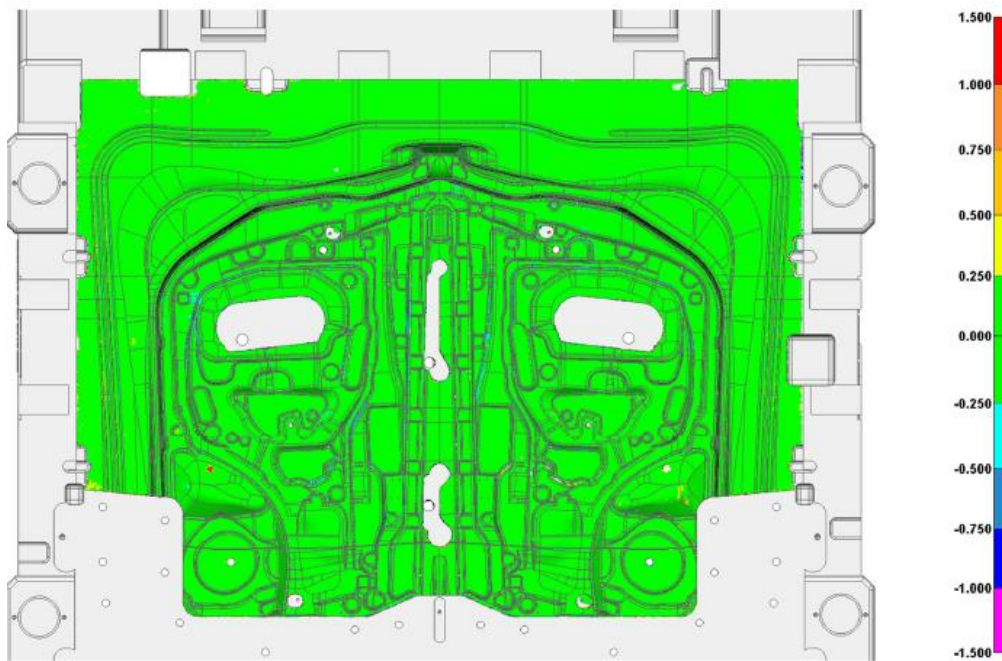
Typical Hardness reaches the theoretical hardness of the material

Hardness Depth: 1-1.5 mm (0.040-0.060")

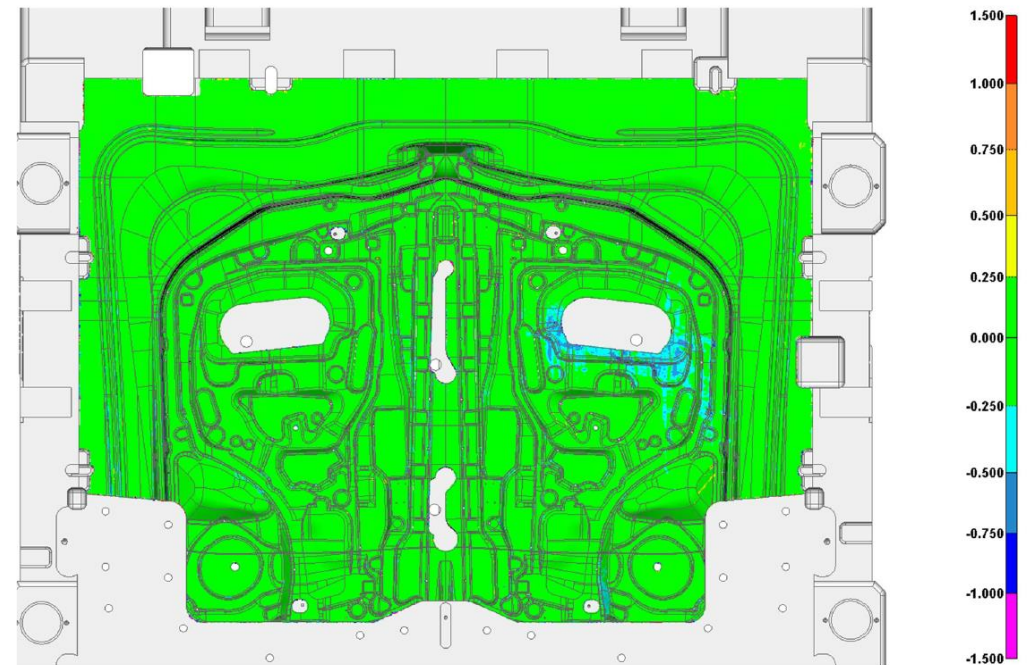


DISTORTION DATA

- 3D scans of the die before and after laser heat treating show negligible distortion



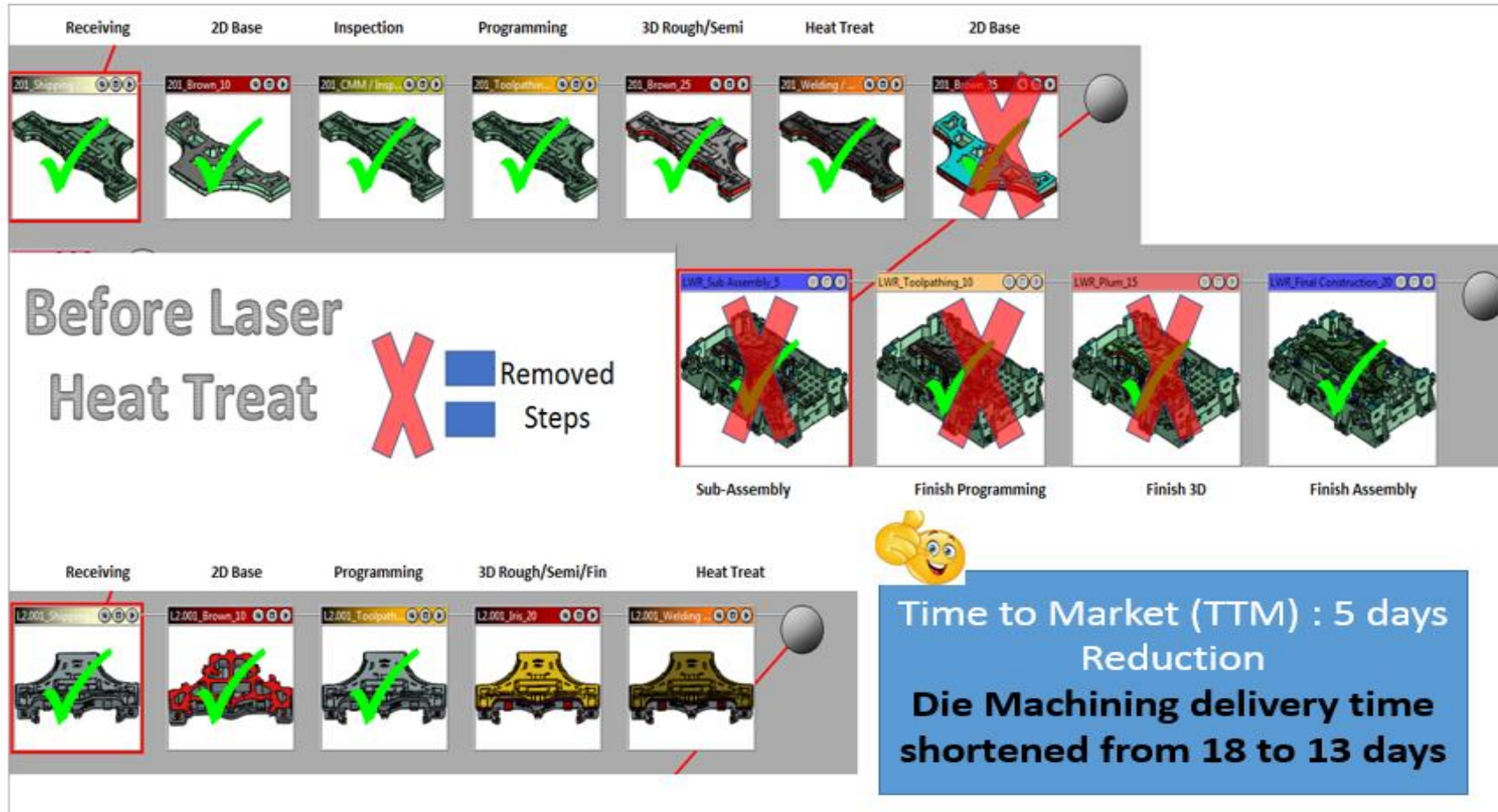
Die scan before Laser Heat Treating



Die scan After Laser Heat Treating

DIE CONSTRUCTION COMPARISON

A Comparison of the Die Construction Process Before & After Laser Hardening



COST SAVINGS, 11-MONTH RESULTS

- Over 100 applicable draw die castings (post, binders and cavities) have been completed on the 3 programs.
- While the heat treating and non-perimeter shipping cost increased, this was offset by total process cost savings.
- Kaizen savings had a benefit to cost average of **28.6** over 11-months.
- Critical resource savings; **37%** reduction in machine time in our CNC Machine department.
- Cutter cost reduction of \$17,850 as the castings are now finished by 3D machining while in soft condition, no hard cut process is required.
- Analyzing the results from these 100 castings **TTM averaged a 7-day** improvement.
- This resulted in a **40%** reduction in a draw die machining process.

NEW ADVANCEMENTS

HOT STAMPING DIES

- Hot stamping dies consists of several sections joined together
- Conventional process – Induction/flame/oven
- Conventional heat treating requires complete dis-assembly prior to heat treating
- No dis-assembly is required for laser heat treated dies
- Net process speed up of approximately 5 days



NEW ADVANCEMENTS – TRIM DIES

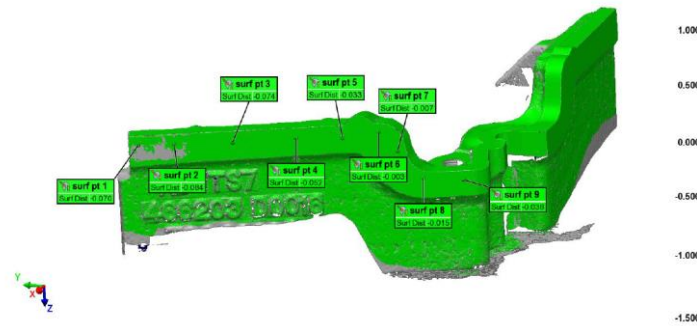
Laser Heat Treating on Trim dies and Inserts

Current challenges:

- Hardness consistency
- Insert base warpage
- Rolled joint lines using either flame or induction hand applied methods

Benefits of using Laser Heat Treating:

- Eliminate machining joints after heat treat
- Reduce / eliminate finish profile hard cut
- One assembly process - laser heat treating after the trim inserts are fully assembled
- Eliminate requalifying of insert base flatness



NEW ADVANCEMENTS ADDITIVE MANUFACTURING

- Die reconfiguration
- Die buildup



SUMMARY

- Laser heat treating results in minimal to no distortion in large automotive dies
- The process has Kaizen savings had a benefit to cost average of **28.6** over 11-months.
- Critical resource savings; **37%** reduction in machine time in our CNC Machine department.
- Cutter cost reduction of \$17,850 as the castings are now finished by 3D machining while in soft condition, no hard cut process is required.
- Analyzing the results from these 100 castings **TTM averaged a 7-day** improvement.
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FOR MORE INFORMATION

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