PRESS HARDENED SHEET STEEL
“HOT STAMPING”
STRONG AND LIGHT AUTO BODY-IN-WHITES

2017 Cadillac XT5 Body Structure
Source: http://www.boronextrication.com
OCCUPANT CRASH PROTECTION

Source: http://www.boronextrication.com

Superior Cam  Midland Design  Bespro Pattern  American Tooling Center
REDUCING AUTO BODY WEIGHT

• CRITICAL FOR IMPROVING FUEL CONSUMPTION
• ENABLES ELECTRIC AND FUEL CELL PROPULSION
• IMPROVES VEHICLE PERFORMANCE & HANDLING
• HELPS MINIMIZE CARBON FOOTPRINT/CO2
• INCREASES PAYLOADS/TOWING CAPACITY
• GLOBALLY COMPETITIVE STRUCTURAL STRATEGIES
REDUCING AUTO BODY WEIGHT

- STEEL INTENSIVE (UHS, AHSS)
- ALUMINUM INTENSIVE
- MIXED MATERIALS
- COST/PERFORMANCE RATIOS
PRESS HARDENING PROCESS

• STAMPING SHEET METAL INTO FORMED AUTOMOTIVE PARTS IS A MATURE PROCESS
• HARDENING STEEL AUTOMOTIVE PARTS WITH HEAT TREATING IS ALSO A MATURE PROCESS
• PRESS HARDENED STEEL COMBINES STAMPING AND HEAT TREATING BUT IS STILL IN ITS INFANCY!
PRESS HARDENING PROCESS
PRESS HARDENING PROCESS
PRESS HARDENED TOOLING CHALLENGES
WATER COOLED TOOLING

Superior Cam
Midland Design
Bespro Pattern
American Tooling Center
THERMAL TRANSFER SIMULATIONS (THERMOMECHANICAL & CFD)
HEAT TREAT PROCESS DATA LOGGING

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**Diagram 1:**
- Heat map of temperature distribution
- Legend for temperature ranges

**Diagram 2:**
- Graph showing temperature vs. time for specific processes
- Data points plotted for each temperature range

**Logos:**
- Superior Cam
- Midland Design
- Bespro Pattern
- American Tooling Center
PRESS HARDENED TOOLING CHALLENGES

• FORMED PARTS ARE TOO HARD TO CUT WITH STAMPING DIES

• THEY MUST BE TRIMMED AND PIERCED USING 5 AXIS CNC HIGH POWERED FIBER LASER CUTTING CELLS

• TRIMMED HOLES AND EDGES MUST BE CUT TO EXTREMELY PRECISE DIMENSIONS

• LASER CUTTING COST REDUCTION
MECHANICAL AND METALLURGICAL TESTS

MECHANICAL AND METALLURGICAL PROPERTIES MUST BE 100% CERTIFIED AND TRACEABLE FOR CRITICAL SAFETY RELATED STRUCTURAL APPLICATIONS
PRESS HARDENED TOOLING CHALLENGES

NEW MATERIALS ARE BEING INTRODUCED THAT REQUIRE DIFFERENT HEAT TREATMENT AND FORMING METHODS

• HARDER STEEL (2000 MPA)
• DUCTILE STEELS (1000 MPA)
• ZINC AND OTHER COATINGS
• LASER WELDED BLANKS - COMBINE DIFFERENT MATERIALS, THICKNESSES
• TAILORED MECHANICAL PROPERTIES (SOFT ZONES)

MATERIALS SUCH AS ALUMINUM AND CARBON FIBER CAN ALSO BE THERMALLY PROCESSED IN HOT FORMING PRESS LINES

• HOT FORMED ALUMINUM
• WARM FORMED ALUMINUM
• WARM FORMED MAGNESIUM
• WARM FORMED CARBON FIBER REINFORCED PLASTIC
PRESS HARDENED PROCESS DEVELOPMENT

• DEVELOPING AND OPTIMIZING APPROPRIATE THERMAL PROCESSING OF PRESS HARDENED STEEL AND OTHER THERMALLY PROCESSED MATERIALS REQUIRES SIGNIFICANT AND ONGOING R&D ACTIVITIES

• METALLURGICAL UNIVERSITIES IN EUROPE, ASIA AND CANADA HAVE DEVELOPED STRONG PROGRAMS FOR OVER A DECADE EDUCATING SCHOLARS AND STUDENTS WHILE SUPPORTING CORPORATE R&D

• TECHNICAL CENTERS IN EUROPE AND ASIA HAVE BEEN HELPING MANUFACTURERS TRAIN THEIR EMPLOYEES IN PHS PROCESSING AND TOOLS OVER THE LAST DECADE
PRESS HARDENED PROCESS DEVELOPMENT

• GROWTH OF CRITICALLY REQUIRED LIGHTWEIGHTING IN AUTOMOTIVE AND OTHER INDUSTRIES DEPENDS ON PHS TECHNICAL CENTERS FOR TOOL AND HEAT TREAT PROCESS DEVELOPMENT, TRYOUT AND PRODUCTION OPTIMIZATION

• PHS TECHNICAL CENTER REQUIREMENTS:
  • HOT FORM PRESS LINE(S)
  • LASER CUTTING CELLS
  • TOOLING AND PROCESS ENGINEERING AND DESIGN CENTER
  • ACCREDITED METALLURGICAL LABORATORY WITH PHS FOCUS
  • HIGHLY EDUCATED AND EXPERIENCED TOOL AND PRODUCTION WORKFORCE
  • TRAINING FACILITIES WITH ACCREDITED INSTRUCTORS
PRESS HARDENED STEEL - SUMMARY

• IT’S A CRITICAL PROCESS FOR LIGHTWEIGHTING AUTOMOBILES
• PHS IS A NEW AND RAPIDLY GROWING PROCESS IN NORTH AMERICA
• PRODUCTION COSTS MUST REMAIN COMPETITIVE WITH AHSS GEN3
• HOMELINES CANNOT SUPPORT TECHNICAL DEVELOPMENT
• TOOLING SOURCES NEED TO DEVELOP AND OPTIMIZE THE PROCESSES
• LIMITED TOOLING RESOURCES WITH PHS KNOWLEDGE ARE AVAILABLE
• THE KNOWLEDGE BASE FOR R&D, PRODUCTION IS IN EUROPE AND ASIA
• REGIONAL TRAINING AND DEVELOPMENT IS NEEDED NOW
PRESS HARDENED SHEET STEEL
“HOT STAMPING”