Fall, 2010

Volume 8, No. 3

DEFORM™ News

Events:

- May 4 & 5, 2011: The U.S. DEFORM User Group Meeting will be held in Naples, Florida in conjunction with a DEFORM Distributors Meeting.
- May 23-25, 2011: SFTC will exhibit DEFORM at Aeromat 2011 in Long Beach, CA.

Training:

- December 7 & 8, 2010: DEFORM-2D training (includes DEFORM-F2) will be conducted at the SFTC office.
- December 9 & 10, 2010: DEFORM-3D training (includes DEFORM-F3) will be conducted at the SFTC office.
- February 8 & 9, 2011:DEFORM-2D training (includes DEFORM-F2) will be conducted at the SFTC office.
- February 10 & 11, 2011: DEFORM-3D training (includes DEFORM-F3) will be conducted at the SFTC office.
- May 5 & 6, 2011:Advanced DEFORM Training will be held in conjunction with the Spring Users Group Meeting in Naples, Florida.

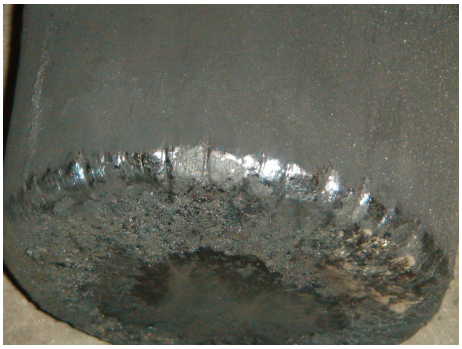
Ring Rolling Preforms

In December, 2009, a project was initiated by the Forging Industry Association (FIA) to study the elimination of coal dust from ring rolling performs. The process includes an upset, open die piercing and trim operation. Most ring rollers use similar processes to produce these blanks.

Since the process is open die, removing the punch can be a challenge. Thus, companies have resorted to placing coal dust on the upset billet, which results in a forceful ejection process.

Team members included FIA, SFTC, Ringmasters, Frisa and McInnes. This team went through a process that included documenting the 'as is' process for six production parts with a history of sticking punches. DEFORM was used to identify the root cause of the problem and test concepts to allow the process to run without coal dust. Multiple team meetings were conducted in person and over the internet to review in-process results and conclusions. A trial, conducted at McInnes on June 16, 2010, demonstrated that the improvements could produce blanks without the use of coal dust.

The punches are generally produced from alloy steel, such as 4340. They are initially heat treated to a hardness of Rc 36 – 40. Punch designs vary by manufacturer, but all include a small to moderate taper on the major diameter. Punches fail by a combination of thermal fatigue, wear and plastic deformation, as shown.



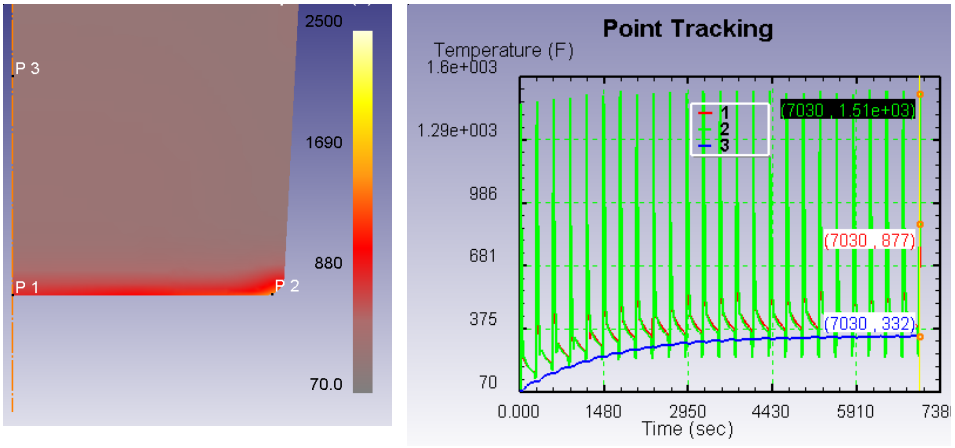
DEFORM was used to simulate the entire production cycle using the multiple operations (MO) capability. Punch temperature, stress, wear and metal flow were all studied in these six production parts. Elasto-plastic models were used to understand the plastic deformation observed on the punch nose. Based on the simulated temperatures in service, hardness tests were conducted on a wide range of punches to confirm that they were fully tempered.

The coal dust is applied to the workpiece prior to piercing (left), resulting in a controlled explosion (right) that 'assists' with retracting the punch.

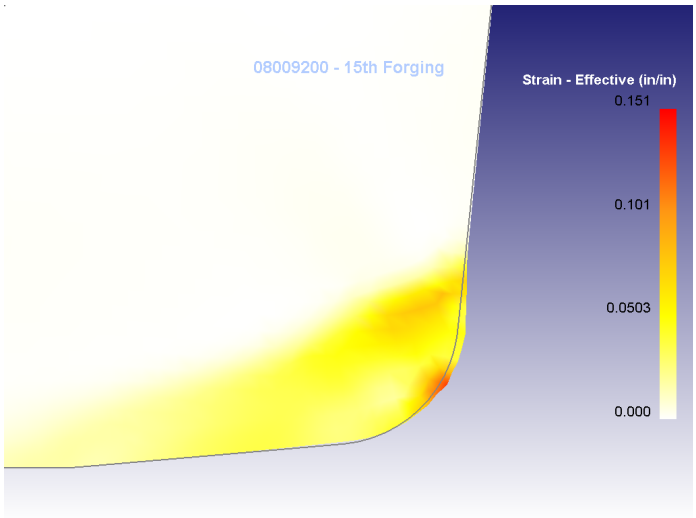
DEFORM™

Design Environment for FORMing

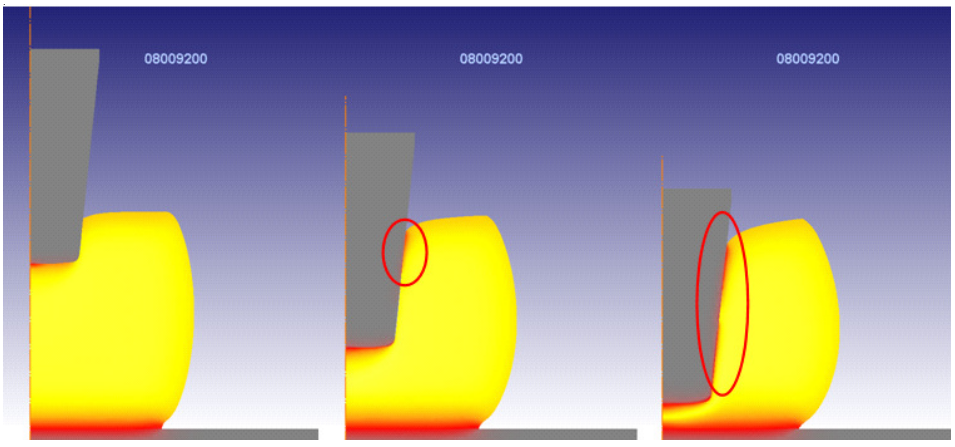
DEFORM results provided insight into the issues that caused punches to stick, resulting use of coal dust. One by one, improvements were implemented that resulted in multiple runs without punch sticking or other failures. The revisions included die design, material and process control. There are clearly combinations of process and geometry that can result in sticking. These are becoming better understood with time and production experience. A recent article in Forging Magazine described the project and a presentation will be made at the 2011 Forging Industry Technical Conference.



Multiple operations were used to simulate a series of forging operations, resulting in both the steady state punch temperature and transient extremes.



Plastic deformation of the punch nose matched production data.



The tapered punch design forced contact during the stroke, resulting in chilling and shrinking the workpiece on a punch that is rapidly heating due to contact. Temperature is shown, where yellow is hot and red is chilled material.

Releases:

DEFORM V10.1(sp2) was released on October 4th, 2010 and included the following enhancements:

- Stability issues related to self contact handling using 64 bit FEM have been addressed.
- Path movement support has been added in the 2D FEM engine.
- Density driven elastic volume changes were added to support sintering computations.
- Creep model bugs were fixed.
- Improvements to mapped mesh were included.
- A grain kinetics bug was fixed for JMAK models.
- Improved convergence checks for multi stand ALE rolling models were developed.
- A scheduled remesh between the operations was added to MO2.
- Improved procedures for MPI runs in Linux environments to handle leftover process threads were made.
- Additional materials were added to the material library.

DEFORM V10.2 and V11.0 (beta) are planned for release in the first half of 2011. Planned improvements include:

- Systems will be built using Absoft f90 V11.0 compiler for improved performance
- More stable and efficient Mpich2 libraries are used for parallel runs in multi CPU environments.
- 64 bit FEM systems will include support for user routines.
- The 3D geometry tool has been enhanced.
- Procedures will be developed to carry out optimization runs in 3D.
- Batch post processing will be added.
- The 3D extrusion module will be enhanced.
- Mesoscale modeling facilities and resistance heating in 3D will be added.
- Induction heating functionality will handle dual frequencies.
- Window 7, Centos 5.5 Linux and Suse Enterprise Linux will be supported.

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