Summer, 2008

Volume 6, No. 3

DEFORM™ News

Events:

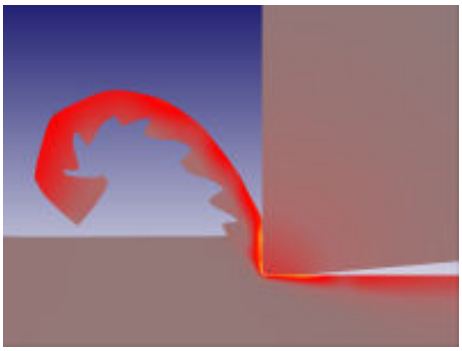
- November 11 & 12, 2008: The Fall DEFORM User Group Meeting in North America is being planned at this time. Details will be announced as soon as they are available. Watch our web site for additional information.
- September 7 - 9, 2008: SFTC will exhibit DEFORM at the International Forging Congress at the Sheraton Chicago Hotel in downtown Chicago, Illinois.
- September 7 - 13, 2008: SFTC will exhibit DEFORM at the International Machine Tool Show at McCormick Place in Chicago, Illinois.

Training:

- October 1 & 2, 2008: DEFORM-2D training (includes DEFORM-F2) will be conducted at SFTC in Columbus, Ohio.
- October 3 & 4, 2008: DEFORM-3D training (includes DEFORM-F3) will be conducted at the SFTC office.
- August 13 & 14, 2008: The annual Die Stress Analysis Workshop will be conducted at Marquette University in Milwaukee, Wisconsin.

White Layer in Machining

In machining processes, worn tools or less than optimum cutting conditions can cause a surface microstructure defect known as "white layer". While the surface layer is typically less than 0.02mm thick, it can have a severe influence on fatigue life. Studies have shown up to 9x reduction in low cycle fatigue life due to the presence of white layer. Using simulation to understand and avoid such damage would be advantageous to manufacturers of fatigue critical parts.



This simulation result shows elevated workpiece surface temperature which contributes to white layer formation.

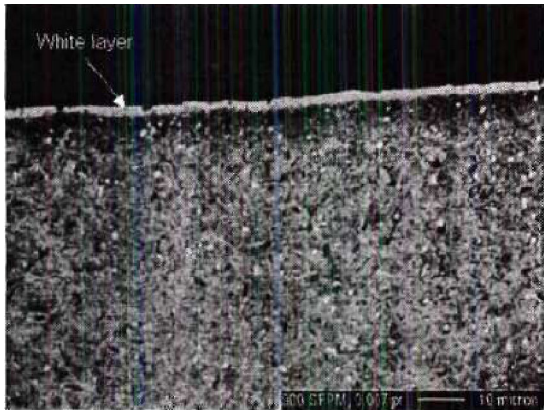
It is generally understood that white layer is caused by abusive machining conditions. In steels, it is believed to be the effect of austenite formation, followed by rapid cooling. The result is a thin layer of martensite. In other alloys, recrystallization or changes in precipitate structure can be the root cause.

In separate studies, Georgia Tech researchers Han and Ramesh measured surface temperature and white layer depth for quench and tempered AISI 52100 and for annealed AISI 1045. The experimental studies varied cutting speed and amount of flank wear.

Cutting conditions for a total of eight cases (five AISI 1045, three AISI 52100) were simulated in DEFORM-2D.

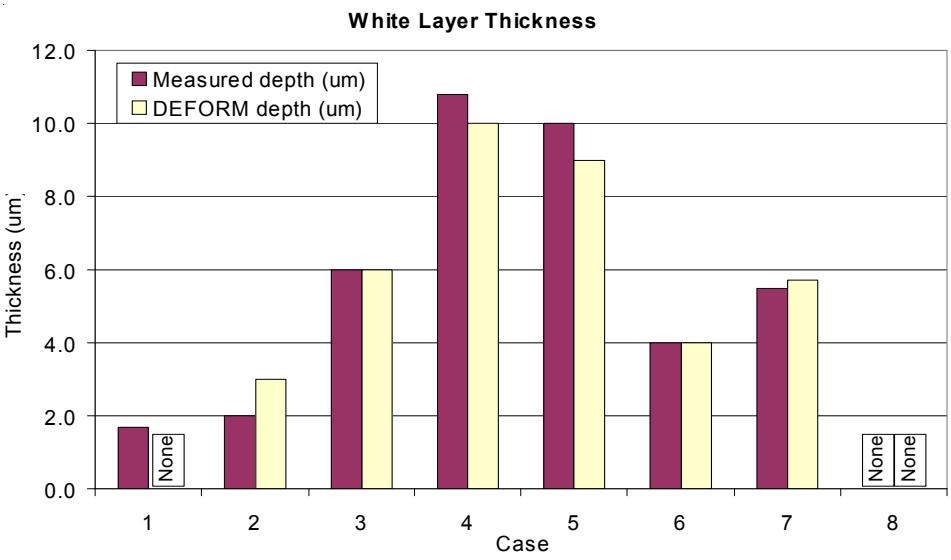
DEFORM's integrated architecture allows the use of microstructure transformation models to predict phase transformation in machining processes. Simulations were performed using published flow stress data for machining, and microstructure transformation data from the DEFORM material library. For the interpretation of results, the thickness of the transformed martensite layer was compared to the experimentally measured white layer depth. In all eight cases, there was good agreement between experimentally measured white layer depth and simulated martensite layer thickness. DEFORM simulation results for surface temperature also agreed well with experimentally measured values in the AISI 1045 experiments.

These results demonstrate the applicability of DEFORM for simulating surface effects in machining. DEFORM simulations can be used to improve processing efficiency by identifying acceptable cutting conditions and wear limits on tools.



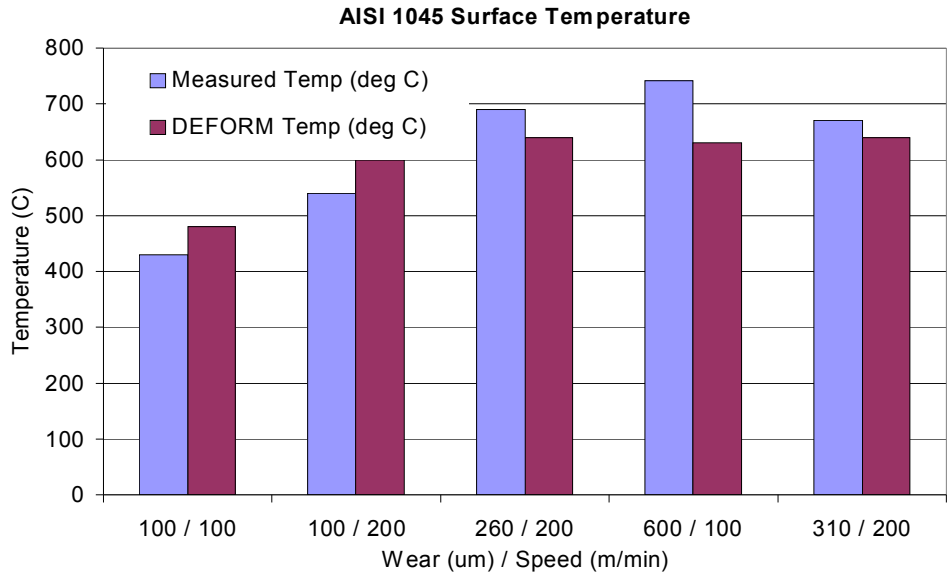
This micrograph shows martensitic white layer in AISI 52100. (Ramesh 2002)

DEFORM™
Design Environment for FORMing



The graph shows good agreement between experimental and simulated white layer thickness.

Case	1	2	3	4	5	6	7	8
Material	1045	1045	1045	1045	1045	52100	52100	52100
Speed (m/min)	100	200	200	100	200	100	300	300
Wear (um)	100	100	260	600	310	100	100	0



Thermocouple temperature measurements compare favorably with DEFORM simulations.

Releases:

DEFORM-3D V6.1.2 and DEFORM-F3 V6.1.2 were released in February. DEFORM-2D V9.1.1 was released in March. DEFORM-F2 V9.1.1 was released in early April.

DEFORM-3D V6.1.3 was released in May. These service packs are primarily bug fixes and code refinements.

A major release is planned for 2008. Version 10.0 will include 2D - 3D integration, license manager improvements, multiple material groups and developments in shape rolling and ring rolling. Additionally, compiler and operating system studies are being performed to improve system performance.

More details on the 10.0 release will be presented at the upcoming DEFORM Users Group Meeting. For specific details, please contact SFTC.

Watch for our new web site in late July. The URL will remain www.deform.com.

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