LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

UCRL-ID-139582-Q3-FY03

Development of a Rolling Process Design Tool for use in Improving Hot Roll Slab Recovery Quarterly Report: Q3 FY03

Dr. R. Couch, Dr. P. Wang

July 31, 2003

Development of a Rolling Process Design Tool for Use in Improving Hot Roll Slab Recovery

Lawrence Livermore National Laboratory
Principal Investigator: **Dr. Richard Couch**
PO Box 808; L-99
Livermore, CA 94550
Phone: 925-422-1655
FAX: 925-422-3389
couch1@llnl.gov

and by

Alcoa Incorporated
Principal Investigator: **Dr. Paul Wang**
Alcoa Technology Center
ATC-B
100 Technical Drive
Alcoa Center, PA 15069
Phone:724-337-2004
FAX: 724-337-2005
Paul.Wang@alcoa.com

Quarterly Report: Q3 FY03

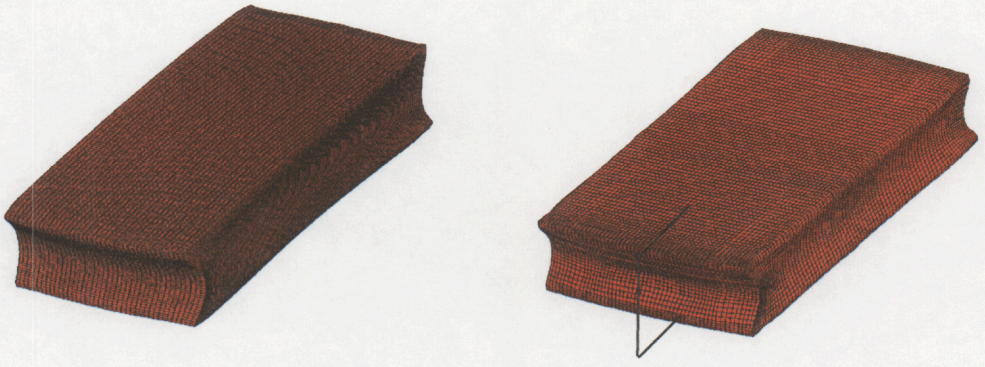
LLNL Input

In this quarter, an FEM simulation has been performed to compare the shape of the deformed slab after the 8th reduction pass with the experimental metrology data provided by Alcoa Technical Center (ATC). Also, a bug in the thermal contact algorithm used in parallel processing have been identified and corrected for consistent thermal solutions between the rollers and the slab.

The overall shape of the slab at the end of the 8th pass is shown in Figure 1. Comparison of the sectional views at the center plane along the length of the slab for both experiment and simulation, shows that the curvature at the slab mouth at the centerline is slightly higher than the experimental result as shown in Figure 2. We are currently focusing on tuning the parameter values used in the simulation and a more complete parametric study for validation is underway.

Also, unexpected fracture occurred along the surface of the slab in the 9th pass as shown in Figure 3. We believe that the reason is due to previously noted inadequacies in the fracture model at low strain rates and high stress triaxiality. We are expecting to receive a modified fracture model based on additional experiment shortly from Alcoa.

Validation simulations for the refined fracture model will be performed when the model becomes available.



a) Experiment b) Simulation

Figure 1 Shape geometry at the end of 8th pass for a) experiment, and b) simulation

a) Experiment b) Simulation

Figure 2 Slab geometry at the centerline of the slab at the end of the 8th pass for a) Experiment, and b) FEM simulation.

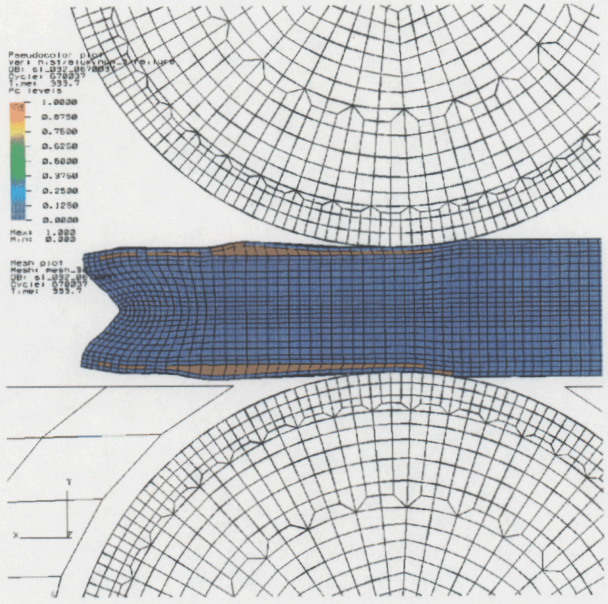


Figure 3 Facture plot at the center plane of the slab. Red color indicates fractured element.

Alcoa Input

Protected CRADA Information

Quarterly Report – Alcoa Contract 74518, Development of A rolling Process Design Tool

From April 1, 2003 to June 30, 2003

- License agreement between LLNL and Alcoa for government software (ALE3D) transferred to industrial use has been initiated and signed.

- Additional Data analysis of lab rolled slabs (protected CRADA information) Alcoa's 3D Coordinate Machine recorded dimensional data of the three lab rolled slabs. The data was then imported to CAD machine to be converted into Abaqus FEM input deck. The first set of dimensional data was transferred in 1Q to LLNL personnel for simulation comparison. The additional two sets of data were transferred to LLNL in 2Q, 2003. LLNL plans to compare these experimental data with numerical results obtained from ALE3D.

- Note:
  1. Alcoa proprietary data means the data was developed by Alcoa before this CRADA activity started

2. Protected CRADA information means Alcoa data was produced in performance of this CRADA project. This data can not be released for 5 years
3. All data generated by LLNL under this CRADA project is restricted under the rules governed by "Protected CRADA Data"

DOE F 4600.6
(09-94)
Replaces EIA-459F
All Other Editions Are Obsolete

OMB Control No.
1910-0400

U.S. DEPARTMENT OF ENERGY
FEDERAL ASSISTANCE PROGRAM/PROJECT STATUS REPORT

OMB Burden Disclosure Statement

Public reporting burden for this collection of information is estimated to average 47.5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of Information Resources Management Policy, Plans, and Oversight, Records Management Division, HR-422 – GTN, Paperwork Reduction Project (1910-0400), U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585; and to the Office of Management and Budget (OMB), Paperwork Reduction Project (1910-0400), Washington, DC 20503.

1. Program/Project Identification No.	**2. Program/Project Title Development of a Rolling Process Design Tool for Use in Improving Hot Roll Slab Recovery**	3. Reporting Period 3/01/03 through 6/30/03
4. Name and Address PI: Richard Couch; Lawrence Livermore National Laboratory; L-99; P.O. Box 808; Livermore, CA 94550		5. Program/Project Start Date 06/01/01 6. Completion Date 05/31/04

7. Approach Changes

[x] None

8. Performance Variances, Accomplishments, or Problems

[x] None

9. Open Items

[x] None

10. Status Assessment and Forecast

[x] No Deviation from Plan is Expected

11. Description of Attachments

[x] None

12. Signature of Recipient and Date	13. Signature of U.S. Department of Energy (DOE) Reviewing Representative and Date

U.S. Department of Energy
Milestone Log

Development of a Rolling Process Design Tool for Use in Improving Hot Roll Slab Recovery

Identification Number	Description	Planned Completion Date	Actual Completion Date
1.	Constitutive model defined: PQ3	3/02	3/02
2.	Fracture model defined: PQ5	9/02	9/02
3.	Friction model defined: PQ3	3/02	3/02
4.	Finite element model constructed: PQ4	6/02	6/02
5.	Rolling data produced: PQ6	12/02	12/02
6.	Initial code validation studies completed: PQ8	6/03	6/03
7.	Validate models in a production configuration: PQ10	12/03	
8.	Complete parameter study: PQ12	6/04	