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# Quarterly Report 9/30/03

Richard G. Couch

October 2, 2003

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

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## **Quarterly Report: Q4FY03**

### **LLNL Input**

In this quarter, LLNL personnel traveled to the Alcoa Technical Center to discuss the current status of simulations and experiments. The previously noted deficiencies of the fracture model were discussed in detail as were ways to improve its functional form to ensure reasonable behavior over a wide range of pressures and strain rates. Additional experiments to calibrate the model at low strain rates and high triaxiality were reviewed. We expect that ATC will provide the refined fracture model to LLNL shortly. Once available, appropriate modifications will be made in the FEM subroutines, and the validation process for the fracture model will continue.

A simulation is being performed to validate the FEM model for a production facility mill configuration. The current focus is on the evolution of the deformed slab shape with increasing number of reduction passes. A detailed comparison of the slab side profile with experimental results is currently being carried out to identify key parameters controlling the simulated shape. Preliminary results show that the friction model plays a dominant role in the intermediate and final profile shapes. Using details of the deformed shape as a validation metric, additional simulations will be performed to optimize parameter values.

## **AlcoaInput**

ProtectedCRADAInformation

QuarterlyReport –AlcoaContract74518,DevelopmentofArollingProcessDesign Tool

FromJuly1,2003toSeptember30,2003

- Completedadditionaltorsionfracturedataandlowerstrainratetensilefracturedata ofAlcoa's5xxxalloy.ThesetwosetsofdatawillenableAlcoapersonnelto develop anadvancedfracturelimitdiagramsin4Q,2003forLLNLmodelinguse.
- LLNLteamvisitedAlcoaCenteronAugust25and26,andhadsuccessfully implementedaversionofALE3DtoAlcoaparallelcomputingsystem.Thevisitalso generatedadditionalinterestofusingsuchtoolstodescribetheevolutionofedge profilesofrolledslabs.

Note:

1. AlcoaproprietarydatameansthedatawasdevelopedbyAlcoabeforethis CRADAactivitystarted
2. ProtectedCRADAinformationmeansAlcoadatawasproducedinperformance ofthisCRADAproject.Thisdatacannotbereleasedfor5years
3. AlldatageneratedbyLLNLunderthisCRADAprojectisrestrictedunderthe rulesgovernedby“ProtectedCRADAData”

DOEF4600.6  
 (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**

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

7. Approach Changes

None

8. Performance Variances, Accomplishments, or Problems

None

9. Open Items

None

10. Status Assessment and Forecast

No Deviation from Plan is Expected

11. Description of Attachments

None

12. Signature of Recipient and Date

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

**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	