

# Continuous Casting Consortium

## Annual Report

University of Illinois, August 14, 2013

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4. Rui Liu Multiphase Mold Flow Model at Severstal  
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7. K. Jin Bubble entrapment with Multiphase Flow and EMBR: Model Validation with Measurements at Baosteel
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9. K. Swartz Modeling Mold Flux Entrainment  
L. Hibbeler

videos:

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09-SWARTZ-K-Entrainment\_Coarse.avi  
09-SWARTZ-K-Transient\_Test\_Problem\_Animation.avi

- 10A. P. Duvvuri Mold Heat Transfer  
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11. B. Petrus Dynamic Thermal Behavior with CONOFFLINE

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11\_PETRUS-B\_Slice\_temperature\_moving\_through\_caster  
11\_PETRUS-B\_Speed\_change\_in\_conventional\_slab\_caster

- 12A. L. Hibbeler Modeling and On-Line Measurement of Narrow Face Mold Taper  
12B. L. Hibbeler Stress Analysis of Dendritic Microstructure During Solidification

videos:

12A\_HIBBEKER\_MoldFill  
12B\_HIBBEKER\_Eulerian\_Dendrites

13. A. Murali Improvements to Equilibrium Model of Precipitate Formation

14. M. Zappulla Equilibrium Precipitate Model Graphical User Interface – EQPrecip 1.1

15. K. Xu Heat Transfer, Bulging, and Machine Taper Modeling

16. Y. Li Modeling SEN Preheating with Fluent and GASEQ

17. B.G. Thomas CCC 2013 USB Table of Contents and List of Reports

## **EQPrecip 1.1 (CCC Precipitation Model – Equilibrium)**

(K. Xu and A. Murali program; M. Zappulla GUI)

Windows 32 and Windows 64 versions of:

1. Readme.txt
2. MCR Installer.exe
3. readme
4. SampleInput.txt
5. Xu Kun Equilibrium Precipitate Model Paper

## **2013 CCC Reports**

Mold Flow with EMBR

### **High Fidelity Numerical Investigations of Tailored Magnetic Fields for Defect Reduction in Continuous Casting of Steel**

Ramnik Singh

MS Thesis, University of Illinois, MechSE, 108p, 2013, CCC Report 201301

### **Large Eddy Simulations of Effect of Double-Ruler Electro-magnetic Field on Transient Flow during Continuous Casting**

R. Singh, B.G. Thomas and S.P. Vanka

CCC Report 201302

### **Transient Fluid Flow During Steady Continuous Casting of Steel Slabs**

#### **Part I: Measurements and Modeling of Two-phase Flow**

Seong-Mook Cho, Seon-Hyo Kim, Brian G. Thomas, and Yong-Jin Kim

CCC Report 201303

### **Transient Fluid Flow During Steady Continuous Casting of Steel Slabs**

#### **Part II: Effect of Double-Ruler Electromagnetic Braking (EMBR)**

Seong-Mook Cho, Seon-Hyo Kim, Brian G. Thomas, and Yong-Jin Kim

CCC Report 201304

### **Effects of a Magnetic Field on Turbulent Flow in the Mold Region of a Steel Caster**

Singh, R., B.G. Thomas, and P. Vanka

*Metallurgical and Materials Transactions B*, submitted May, 2013

## **Effect of Electromagnetic Braking (EMBr) on Turbulent Flow in Continuous Casting (reprint)**

Singh, R., B.G. Thomas, and S.P. Vanka

AISTech 2013 Proceedings, Pittsburgh, PA, May 6-8, 2013, Assoc. Iron Steel Technology, Warrendale, PA, pp. 1323-1336.

## **Flow Control with Ruler Electromagnetic Braking (EMBr) in Continuous Casting of Steel Slabs**

Thomas, Brian G., Ramnik Singh, Rajneesh Chaudhary, and Pratap Vanka

Fifth Baosteel Biennial Academic Conference (BAC2013), Shanghai, PRC, June 4-6, 2013.

### Mold Flow Phenomena (other)

## **Mold Slag Entrainment Mechanisms in Continuous Casting Molds (reprint)**

Hibbeler, L.C., and Brian G. Thomas

AISTech 2013 Proceedings, Pittsburgh, PA, May 6-8, 2013, Assoc. Iron Steel Technology, Warrendale, PA, pp. 1215-1230.

## **Slidegate Dithering Effects on Transient Flow and Mold Level Fluctuations (reprint)**

Liu, Rui, Brian G. Thomas, Love Kalra, Tathagata Bhattacharya, and Aloka Dasgupta, AISTech 2013 Proceedings, Pittsburgh, PA, May 6-8, 2013, Assoc. Iron Steel Technology, Warrendale, PA, pp. 1351-1364.

## **Transport and Entrapment of Particles in Steel Continuous Casting (reprint)**

Thomas, B.G., Q. Yuan, S. Mahmood, R. Liu, and R. Chaudhary

*Metallurgical and Materials Transactions B*, in press.

DOI: 10.1007/s11663-013-9916-7.

### Mold Slag Properties

## **Computational Modeling of Temperature, Flow and Crystallization of Mold Slag during Double-Hot-Thermocouple-Technique Experiments**

Zhou, L., W. Wang, R. Liu, and B. G. Thomas

*Metallurgical and Materials Transactions B*, submitted May, 2013

## **Kinetic Study of the Devitrification of Mold Powder Slags (reprint)**

Maldonado, Yadira G., F. Andrés Acosta, A. Humberto Castillejos and Brian G. Thomas

*Iron and Steel Technology*, July, 2013 (reprinted from AISTech 2012, Atlanta, GA, May 7-9, 2012, Assoc. Iron Steel Technology, Warrendale, PA.)

## Fundamental Computational Modeling

### **Measuring Heat Transfer During Spray Cooling Using Controlled Induction Heating Experiments and Computational Models (Reprint)**

Zhou, Xiaoxu, B. G. Thomas, C. Alberto Hernández B., A. Humberto Castillejos E. and F. Andrés Acosta G.

*Applied Mathematical Modeling*, 37, 3181-3192, 2013. DOI: 10.1016/j.apm.2012.07.039

### **Calibration of Thermal Models of Steel Continuous Casting Molds (reprint)**

Hibbeler, L., M. Langeneckert, J. Iwasaki, I. Hwang, R. O'Malley, and B.G. Thomas  
*Iron and Steel Technology Transactions*, 10:5, Sept., 2013.

### **Particle Transport in a Turbulent Square Duct Flow with an Imposed Magnetic Field**

Liu, R., Surya P. Vanka, and Brian G. Thomas

Proceedings of the ASME 2013 Fluids Engineering Division Summer Meeting, FEDSM2013, 16503, Lake Tahoe, Nevada, USA, July 07-11, 2013.

### **Multiphysics Simulation of Metal Solidification Processes with Abaqus**

Koric, Seid, Brian G. Thomas, and Lance Hibbeler

Simulia Community Conference, Vienna, Austria, May 21-24, 2013.