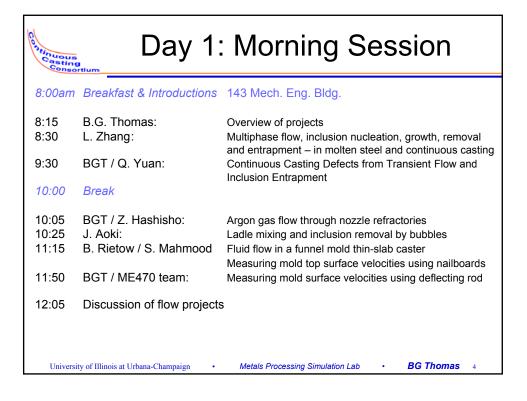


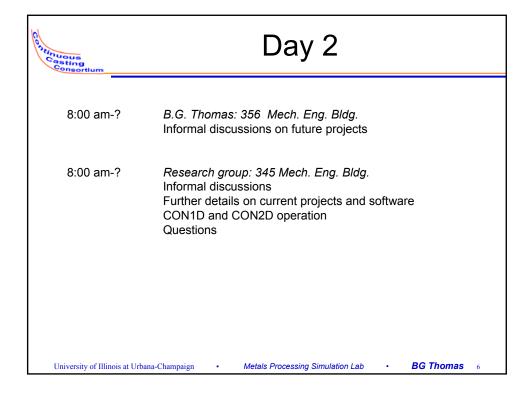
0 0.3 Casting Consortium	Tentative Attendees		
	actories: rdale:	Ron O'Malley & Jay Watson Don Lorento Bart Thompson & Troy Murray(?) Don Griffin, & Rob Nunnington Gary Norgren, Clint Graham, Steve Fiegle & Michael Okelman Claudio Ojeda ? Ho-Jung Shin Ashwini Kumar & Hossam Metwally	
University	of Illinois:	Brian G. Thomas, Joseph Bentsman, Lifeng Zhang, Joydeep Sengupta, Kun Xu, Seid Koric, Kai Zheng, Claudio Ojeda, Jun Aoki, Bret Reitow, Ho-Jung Shin, Sami Vapalahti, Sana Mahmood, Zaher Hashisho & Albert Liu(?)	



# Day 1: Afternoon Session

12:30p	m Lunch	143 Mech. Eng. Bldg.
1:00	BGT / S. Vapalahti:	Calibration of CON1D in mold using 3-D FEM model
1:10	K. Zheng:	Online control of spray cooling using CON1D
1:40	K. Xu:	Modeling of nitride precipitate formation during secondary spray cooling
2:00	Break	
2:05	HJ. Shin:	Investigation of oscillation marks and hook formation in
		ULC steels using metallurgical analysis and models
	J. Sengupta:	Application of CON2D to meniscus behavior
		Mechanism for oscillation and hook formation
3:35	Break	
3:40	C. Ojeda:	Modeling Meniscus fluctuations during oscillation
4:00	S. Koric:	Solidification Stress Modeling using ABAQUS
4:20	L. Zhang:	Continuous Steelmaking – development of a new
		process to continuously melt, refine, and cast high
		quality steel
5:00 Discussion of future projects and directions		
5:30	Adjourn meeting	
6:00	Dinner	Illini Room A, Union Building
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Casting





# **Research Summaries**

Stinuous Casting Consortium

### Initial Solidification and Meniscus Hook Formation in Continuous Slab Casting

B.G. Thomas, \* S.-H. Kim, \* H.-J. Shin, Y. Meng, L. Zhang, J. Sengupta, and C. Ojeda Continuous Casting Consortium\*\*, POSTECH, Korea, and Labein, Spain

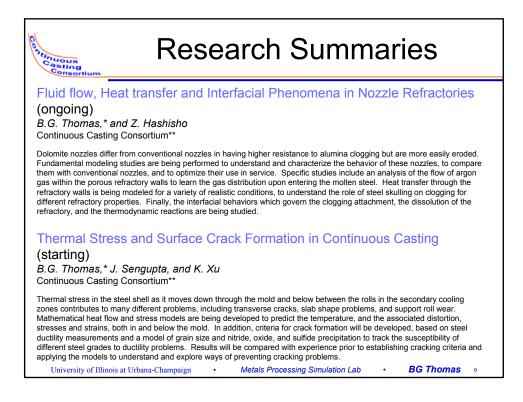
The first few seconds of solidification at the meniscus create the final cast product surface, and may include defects such as deep oscillation marks, surface depressions, and subsurface hooks in the microstructure, if conditions are not optimal. Computational fluid flow, heat flow and stress models of the meniscus region are being developed and applied to simulate these phenomena. Plant measurements such as mold temperature, liquid surface shape, and metallographic examination of oscillation marks and hooks are being conducted on slabs cast at POSCO. Together, ways to optimize casting conditions such as speed, level control, superheat, mold oscillation practice, and mold powder composition are being investigated to minimize meniscus hook depth.

### Online Dynamic Control of Cooling in Continuous Casting of Thin Steel Slabs (ongoing)

B.G. Thomas, \* J. Bentsman\*, Y. Meng, K. Zheng, and S. Vapalahti Continuous Casting Consortium\*\* and National Science Foundation

Temperature variations during cooling cause quality problems such as cracks, especially under transient conditions such as caused by changes in casting speed. Setting the spray water flow rates to maintain optimal temperature profiles during process changes becomes increasingly difficult when the casting speeds are high and response times must be fast. This project aims to develop a fundamentally-based online system to dynamically control the water flow rates in order to continuously optimize and stabilize cooling conditions in the thin slab casting process. The system will use model-based predictive control, incorporating both online measurements of mold heat removal and on a high-speed finite-difference model of heat conduction and solidification during the process.

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## **Research Summaries**

### Development of a Process to Continuously Melt, Refine, and Cast High-**Quality Steel**

#### B.G. Thomas, L. Zhang, and J. Aoki

Department of Energy; University of Missouri - Rolla; Continuous Casting Consortium\*\*

Many operational problems and costs are associated with feeding the continuous casting process from the continuous electric furnace steelmaking operation using via batch ladles. A multifaceted project combining plant experiments, lab experiments, and computational modeling aims to design a fully continuous process using a series of intermediate vessels where alloy addition and refining occurs at steady state. The UIUC role focuses on the computational modeling aspects of the project. Three-dimensional models of multiphase turbulent fluid flow, mixing, and particle motion are being developed to assist with the design calculations. The results will help to design a feasible process, while identifying and solving possible problems prior to the pilot plant stage.

#### Investigation of Steel Cleanliness during Ingot Teeming

#### B.G. Thomas,\* L. Zhang\*, and B. Rietow

#### Ingot Metallurgy Forum

Inclusions trapped during bottom-poured static-cast ingots lead to quality problems in the final product. Computational models of transient, multiphase fluid flow in this process are being developed and applied to improve understanding of inclusion transport and capture. Process parameters, such as teeming rate and runner geometry are being optimized. Plant experiments to measure inclusion locations, refractory wear, and other relevant phenomena are being conducted for additional insight and model validation.

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