

noticeable. Crack formation is well investigated in theory and many techniques for crack prevention are used in practice. Nevertheless starting cracks are a problem in DC casting. This paper presents an investigation on methods to prevent starting cracks in Al-billets production using float and spout DC-casting. Starting with the results of former investigations and practical experience these methods are tested for their suitability for crack prevention. The main focus was to apply all technologies to the float and spout DC-casting. The paper presents the research methods, the results of crack prevention and the real implementation in practice.

11:05 AM

Improving the Surface of AA6111 Sheet Material, Cast at High Speeds, through the Use of Macroscopically Textured Substrates: *Donghui Li*¹; Luis Calzado¹; Mihaiela Isac¹; Roderick Guthrie¹; ¹McGill Metals Processing Centre

The surface topography and coating materials of water cooled belts greatly affect interfacial heat flows, strip surface quality, and as-cast microstructures, for thin strips cast on high speed horizontal single belt casting machines (HSBC). The purpose of this paper was to investigate the surface quality of the strip by casting Aluminum AA6111 alloy on an HSBC simulator using a copper mould with different macroscopic surface textures and coatings. The transient interfacial heat flows were measured by thermocouples embedded in the copper mould. Ab-initio heat flows between the melt and the mould were predicted by mathematical modeling and favorably compared with experimental heat fluxes. It was found that the mould surface texture and coatings could be optimized to mitigate casting defects caused by air pockets entrained at the interface between the melt and rapidly moving mould. Attendant improvements in as-cast microstructures were obtained.

11:25 AM

Reinventing Twin Roll Casting for the 21st Century: *Enrico Romano*¹; Chris Romanowski¹; ¹Fata Hunter

The invention of twin roll casting in 1956 profoundly influenced the Western aluminum industry. The original twin roll casters were low cost machines that economically converted a variety of common alloys into sheet and foil products for the rapidly growing post-war consumer market. To meet market demand for an ever increasing range of alloys and widths, twin roll casters then became progressively bigger, more complex and costly. In recent years the economic growth in developing markets such as India has produced a surge in demand for low cost aluminum products that mirrors the Western post-war economic boom. To meet the requirements of these markets, FATA Hunter has developed a low cost casting machine that combines the low capital and operating costs of the original 1950s casters, with the latest in twin roll casting technology. The design features of this new caster are described and contrasted with a typical large machine.

11:45 AM Concluding Comments

Characterization of Minerals, Metals and Materials: Characterization of Microstructure of Properties of Materials V

Sponsored by: The Minerals, Metals and Materials Society, TMS Extraction and Processing Division, TMS: Materials Characterization Committee, TMS/ASM: Composite Materials Committee
Program Organizers: Toru Okabe, University of Tokyo; Ann Hagni, Geoscience Consultant; Sergio Monteiro, State University of the Northern Rio de Janeiro - UENF

Thursday AM Room: 3009
February 19, 2009 Location: Moscone West Convention Center

Session Chairs: Lawrence Murr, University of Texas; Sergio Monteiro, State University of the Northern Rio de Janeiro - UENF

8:30 AM

Data Driven Reduced Order Models for the Representation of Polycrystalline Microstructures: *Nicholas Zabaras*¹; Baskar Ganapathysubramanian²; ¹Cornell University; ²Iowa State University

The stochastic analysis of a system requires the availability of appropriate input models of the uncertain variables. Constructing reliable input stochastic

models from limited data/information is therefore an important prerequisite for the realistic analysis of complex systems. This is particularly true during physical process modeling in polycrystalline microstructures where the amount of microstructural data is limited or only available in coarse-grained form. We investigate various dimensionality reduction strategies to construct compact, data-driven reduced order models of polycrystalline microstructures. In particular, we compare and analyze features of linear model reduction strategies based on Principal Component Analysis as well as non-linear model reduction strategies based on ideas from manifold learning.

8:45 AM

Development of a Portable Load-Depth Sensing Indentation System for Online Material Characterization: *Chuanyu Feng*¹; Jared Tannenbaum¹; *Bruce Kang*¹; Mary Anne Alvin²; ¹West Virginia University; ²National Energy Technology Laboratory

Indentation technique has a unique position for online material characterization. However, due to the complexity of the indentation depth and/or contact area measurement, current portable indentation instruments are solely developed for the purpose of hardness measurement. Powerful load-depth sensing indentation can be performed only in the lab. Due to this, a load-based indentation technique suitable for field applications has been developed, which does not need any direct measurement of the contact area or depth of indentation. The new technique bears the same theoretical background as traditional load-depth sensing indentation. Additionally, by applying a multiple-partial unloading procedure, the indentation system developed using this technique involves much less cost compared to current commercial products. To demonstrate the feasibility, a portable indentation system suitable for online material characterization has been developed. Excellent measurement results have also been obtained.

9:00 AM

Safety Characterization of Electrical Systems in Diesel Electric Locomotive: *Jeongguk Kim*¹; Chang-Young Lee¹; Seung-Koo Baek¹; Sung Cheol Yoon¹; ¹Korea Railroad Research Inst

In diesel electric locomotives, which were used for over 25 years, the characterization of electrical system was conducted for deterioration and safety evaluation through insulation resistance measurement, degradation testing, and infrared thermography method. Especially an infrared camera and thermocouples were employed for the evaluation. The thermocouples were attached on high-voltage cables connected to traction motors, for in-situ measurement of abnormal heating during test running. After test running, the thermographic images were obtained for the inspection of high-voltage cables using the infrared camera. The thermographic results were quantitatively analyzed, and compared with temperature changes during running. In this investigation, various analysis techniques for the safety characterization of diesel electric locomotives have been introduced, and the analysis results have been used to provide the deterioration or wear information in current locomotive systems.

9:15 AM

Characterization of Hot Spots Generation in Railway Brake Disc: *Jeongguk Kim*¹; Byung Choon Goo¹; Sung Cheol Yoon¹; Sung-Tae Kwon¹; ¹Korea Railroad Research Inst

The generation of hot spots on railway brake disc was investigated using the infrared thermography method. In brake system, the hot spots on the surface of brake disc have been considered as thermal distortions with high thermal gradient, and the control of hot spots has been an important issue for the lifetime extension of brake disc. In this investigation, a brake disc with gray cast iron, which is currently used in Korea, was employed. A high-speed infrared (IR) camera was used to measure the surface temperature of brake disc as well as for in-situ monitoring of hot spot evolution during braking operation. From the thermographic images, the observed hot spots and thermal damage of railway brake disc during braking operation were qualitatively analyzed. Moreover, the previous experimental and theoretical studies on hot spots phenomenon were reviewed, and the current experimental results were introduced and compared with theoretical prediction.