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Cover Photo:

The images show the way of the construction of a laboratory-scale descaling simulator device from the design phase to the implementation and operation. The acid pickling experiments are reported by L. Péter and co-workers on page 704.

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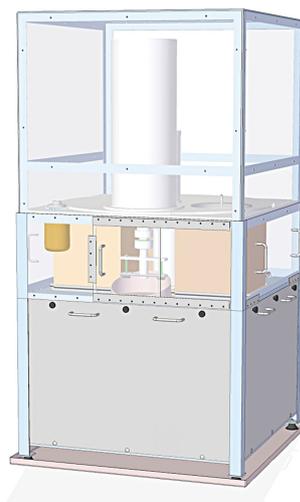
Contents

Full Paper

L. Péter,* O. Sánta, G. Koós, J. Földi, B. Veró, J. Bátonyi, P. Schwarczenbarth, K. Mach, I. Kardos, G. G. Gyerák, B. Vehovszky, and R. D. Lerner

Study of the Acid Pickling of Low-Alloyed Steels by Using a Descaling Workstation Simulating the Production Line

704

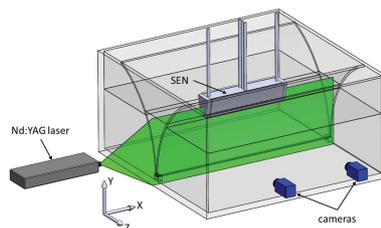


A laboratory-scale workstation has been constructed to study the acid pickling of steel sheets under conditions that are analogous to the production line. The weight loss due to the scale removal as well as the overpickling rate has been measured for various steel grades. The role of various process parameters like immersion time and pulling rate has been studied.

A. Pelss,* A. Rückert, and H. Pfeifer

Physical Simulation of the Flow Field in a Vertical Twin Roll Strip Caster – A Water Model Study

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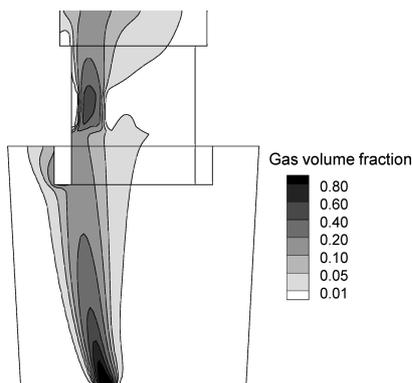
The visualization of the flow inside the pool of a twin roll strip caster is important for the process. In this study, the flow is systematically investigated for different volume flow distributions in a full scale water model. Therefore the particle image velocimetry method and video analysis are used to determine the main flow patterns.

Contents

D.-Q. Geng,* X. Zhang, X.-A. Liu, P. Wang, H.-T. Liu, H.-M. Chen, C.-M. Dai, H. Lei, and J.-C. He

Simulation on Flow Field and Mixing Phenomenon in Single Snorkel Vacuum Degasser

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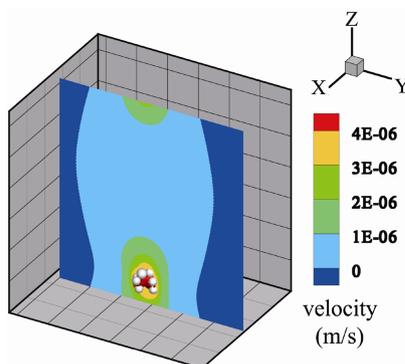


Flow field and mixing phenomenon in single snorkel degasser with ladle bottom blowing has been investigated by numerical method. The results show that the flow field inside the single snorkel vacuum degasser can be optimized in order to achieve higher recirculation rates and smaller mixing times, which are important to refining.

Y. Wang,* H. Li, L. Guo, X. Yu, and B. Zhou

Direct Numerical Simulation of Inclusion Cluster Floating Behavior in Molten Steel Using Lattice Boltzmann Method

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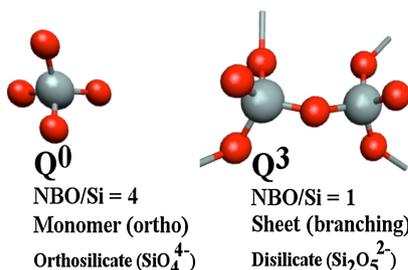


A three-dimensional fractal structure model is introduced to quantify the morphology of inclusion clusters, and the floating behavior of different inclusion clusters is simulated directly using lattice Boltzmann method to investigate the effect of morphology on the floating velocity. By introducing the fractal dimension, an equation for the floatation velocity of cluster-shaped inclusions is derived from the simulation results.

Y. Mohassab and H. Y. Sohn*

Analysis of Slag Chemistry by FTIR-RAS and Raman Spectroscopy: Effect of Water Vapor Content in H₂-H₂O-CO-CO₂ Mixtures Relevant to a Novel Green Ironmaking Technology

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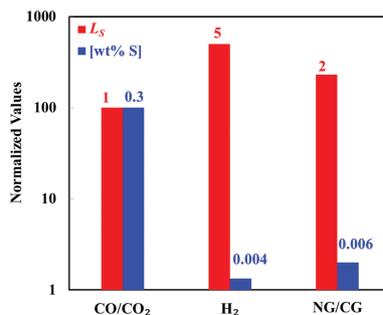


Silicate melt structural entities with their Q-notation, NBO/Si ratios, and structural units in addition to bridging and non-bridging oxygens are shown. The molten slags equilibrated with CO/CO₂/H₂/H₂O mixtures are analyzed by the FTIR-RAS and Raman techniques. H₂O increases polymerization of the silicates. The results provide new insights into the slag chemistry under H₂O-containing atmospheres.

Y. Mohassab and H. Y. Sohn*

Effect of Water Vapor on Sulfur Distribution Between Liquid Fe and MgO-Saturated Slag Relevant to a Flash Ironmaking Technology

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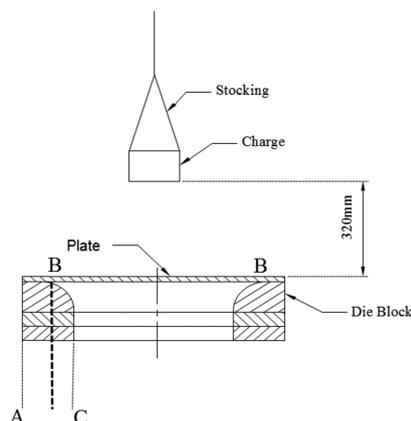
For the first time, the effect of water vapor on the distribution of sulfur between slag and molten iron is studied for MgO-saturated CaO-FeO-Al₂O₃-SiO₂-MnO (0.2–0.8 wt%)-P₂O₅ (0.1–0.9 wt%) slags in the temperature range 1550–1600 °C under CO/CO₂/H₂/H₂O, H₂/H₂O, and CO/CO₂ with pO₂ = 10⁻¹⁰–10⁻⁹ atm. Water in the gas atmosphere is found to increase L_S.

Contents

C.-H. Choi,* C.-T. Peng, B. F. Dixon and H. Li

Pre-Blast Strengthening of Fe-18Mn-0.6C-1.5Al TWIP Steel

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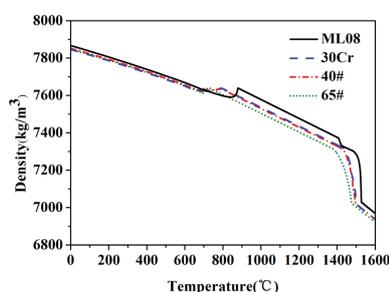


A new challenging simple explosive blast is successfully demonstrated on a high manganese TWIP steel. This innovative technique is developed by the Defence Science and Technology Organisation (DSTO) to maximize resilient strength and hardness with a minimal compensation of elongation and toughness.

Z. Xie and J. Yang*

Calculation of Solidification-Related Thermophysical Properties of Steels Based on Fe-C Pseudobinary Phase Diagram

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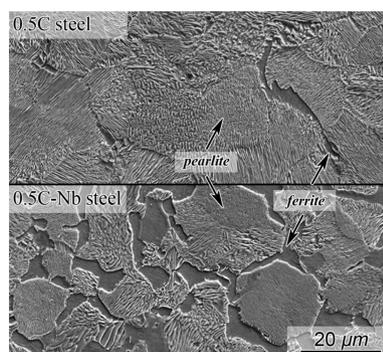


Special algorithms have been developed for calculation of solidification-related thermophysical properties including density, thermal conductivity, enthalpy and specific heat from 1600 to 0 °C for carbon and low alloy steels. The algorithms are based on Fe-C pseudobinary phase diagram of steels. Comparison with software JMatPro and measured data indicates that the algorithms are accurate and applicable.

S. Wu, X.-C. Li, J. Zhang, C.-J. Shang,* and R. D. K. Misra

Microstructural Refinement and Mechanical Properties of High-Speed Niobium-Microalloyed Railway Wheel Steel

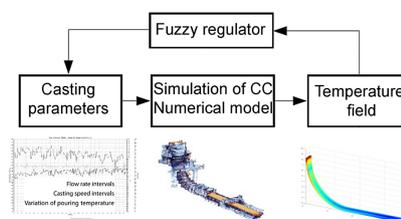
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The microstructure of railway wheel steel is refined and the percentage of ferrite is increased from 4 to 24% with the addition of 0.06% Nb. The addition of Nb inhibits mixed microstructure and delays the coarsening temperature of austenite grains from 880 to 960 °C. The impact energy at -20 °C is increased from 7.0 to 19.0 J with no apparent reduction in tensile strength. The grain refining and precipitation strengthening are roles of niobium in promoting ferrite-pearlite transformation and improving toughness in medium carbon steels.

T. Mauder,* C. Sandera, and J. Stetina
Optimal Control Algorithm for Continuous Casting Process by Using Fuzzy Logic

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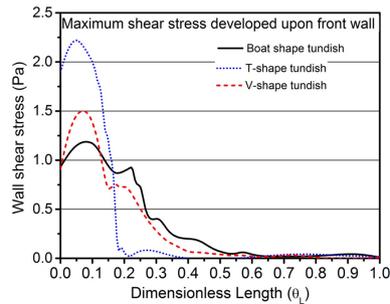


3D numerical model of temperature field for continuous casting is created and verified. The coupling optimization-numerical approach for increasing the quality of casting steel is proposed. The optimization algorithm is based on fuzzy logic. The results show good efficiency, robustness, and general applicability.

Contents

M. I. H. Siddiqui* and P. K. Jha
Numerical Simulation of Flow-Induced Wall Shear Stresses in Three Different Shapes of Multi-Strand Steelmaking Tundishes

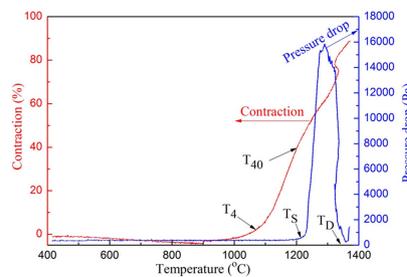
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Numerical investigation of the effect of three different tundish shapes, i.e., boat, T-shape, and V-shape on generation of wall shear stress are carried out. Average wall shear stress value is maximum for V-shape tundish as compared to other two configuration tundishes. Similarity in variation of wall shear stress and turbulent kinetic energy is observed at different walls.

J.-X. Liu, G.-J. Cheng, Z.-G. Liu, M.-S. Chu and X.-X. Xue*
Reduction Process of Pellet Containing High Chromic Vanadium–Titanium Magnetite in Cohesive Zone

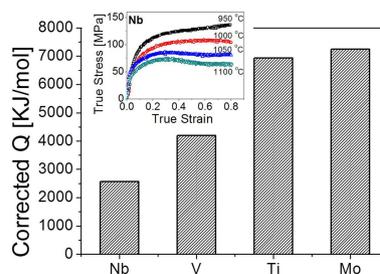
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This paper discusses the softening and melting characteristics, peripheral textures, microstructure of internal core and phase transition of valuable components (Fe, V, Ti, and Cr) of pellet containing high chromic vanadium–titanium magnetite in the cohesive zone of the BF. The Ti(C,N), VN, VC, and FeCr₂O₄ can be generated in the reduction process.

Technical Note
M.-Y. Seok, I.-C. Choi, Y. Zhao, D.-H. Lee, J.-A. Lee, and J.-I. Jang*
Microalloying Effect on the Activation Energy of Hot Deformation

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In this study, through a series of hot compression tests of four different microalloyed steels, the influences of Nb, V, Ti, and Mo on the Q has been systematically explored and has been directly compared the effect of each element in a quantitative manner.

J. Chen* and G.-D. Wang
Precipitation Characteristics in a Low-Carbon Vanadium–Titanium-Bearing Steel

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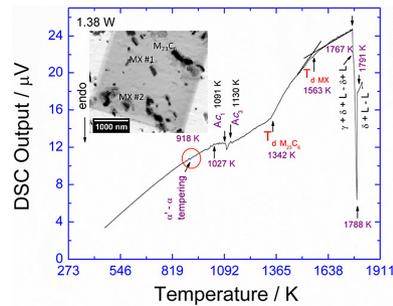
The precipitation hardening attracts more and more researchers' attentions due to its higher strengthening effect and relatively lower brittle vector. The objective of the present work is to investigate the chemical composition, crystal structure, and lattice parameter of nanometer-sized carbides in a lowcarbon vanadium–titanium-bearing steel and the orientation relationships between precipitates and ferrite matrix using transmission electron microscope.

Contents

R. Kirana, S. Raju,* R. Mythili,
S. Saibaba, T. Jayakumar, and
E. Rajendra Kumar

High-Temperature Phase Stability of 9Cr-W-Ta-V-C Based Reduced Activation Ferritic-Martensitic (RAFM) Steels: Effect of W and Ta Additions

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Knowledge based approach to designing power plant steels calls for accurate information on high temperature phase & microstructural stability. In the present study, Dynamic Calorimetry, Electron Microscopy, together with Thermodynamic Simulations, have been carried out to rationalize the observed high temperature phase transformation behaviour of W and Ta added Reduced Activation Ferritic Martensitic (RAFM) Steel.