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Cover Photo:

The amount of scrap is limited by different factors. The presented article by C. Wang et. al. on page 387 describes a model of scrap blending in basic oxygen furnaces.

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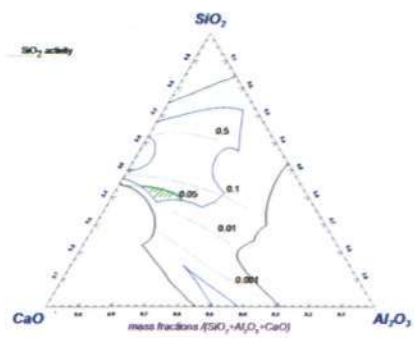
Contents

Full Paper

S. Nurmi, S. Louhenkilpi, and L. Holappa

Optimization of Intensified Silicon Deoxidation

323



Thermodynamic examination of potential slag systems and compositions to equilibrate with Si deoxidized steels having medium carbon and high silicon are scrutinized. The optimal slag composition for producing low-O steels with deformable inclusions is evaluated by using FactSage thermodynamic calculation program. Industrial heats using intensified Si deoxidation and slag based inclusion engineering are produced in a steel mill with 60 tons heat size. Inclusions and slag compositions are inspected and are in satisfactory accordance with the theoretical examinations.

Contents

Z. Baochun*, Z. Tan, L. Guiyan, and L. Qiang

Effect of Thermo-Mechanical Process on Phase Transformation Behaviors of V–Ti–N Microalloyed Steel

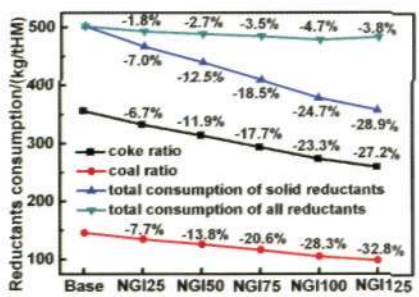
328

This article discloses the effect of thermo-mechanical process on the phase transformation behaviors and the microstructure evolution of V–Ti–N microalloyed steel and constructs the corresponding continuous cooling transformation diagrams (CCT diagrams), which provides a reference to customize the most favorable process for the real production of the steel. As a result, low-cost and high-performance microalloyed steel is produced.

T.-L. Guo, M.-S. Chu, Z.-G. Liu, J. Tang, and J.-I. Yagi

Mathematical Modeling and Exergy Analysis of Blast Furnace Operation With Natural Gas Injection

333

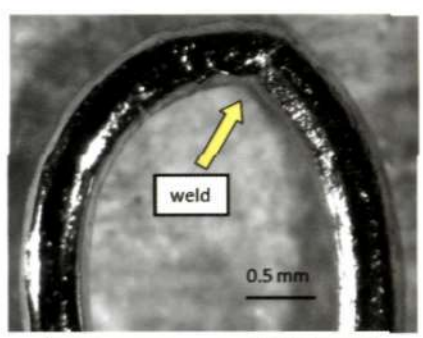


Numerical simulations on blast furnace operation with natural gas *injection are performed in this study.* With increasing natural gas injection volume, the utilization factor of blast furnace is increased from 2.07 to 3.08 $t \cdot m^{-3} \cdot day^{-1}$. For 125.4 $kg \cdot tHM^{-1}$ natural gas injection, coke rate and carbon emission rate are decreased by 27.2% and 32.2%, respectively. The thermodynamic perfection degree is increased from 88.40% to 90.50%.

J. L. Klug, R. Hagemann, N. C. Heck, A. C. F. Vilela, H. P. Heller, and P. R. Scheller

Crystallization Control in Metallurgical Slags *Using the Single Hot Thermocouple* Technique

344



TYPICAL THERMOCOUPLE SHOWING THE REGION WHERE SLAGS SAMPLES ARE MELTED

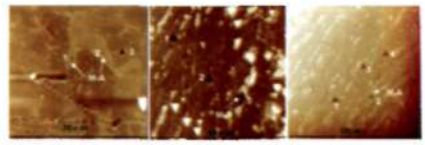
The single hot thermocouple technique can be used to construct time–temperature–transformation (TTT) or continuous-cooling-transformation (CCT) diagrams by in situ observation. A $CaO–Al_2O_3$ slag – 44% CaO, 56% Al_2O_3 (wt%) – and a $CaO–SiO_2$ slag – % CaO/% SiO_2 (wt%) = 0.7 are analyzed, studying their solidification behavior. The accuracy of the apparatus is verified by measuring the crystallization temperature of CaF_2, Na_2SO_4, and K_2SO_4.

Contents

H. F. Lan, L. X. Du, and X. H. Liu

Microstructure and Mechanical Properties of a Low Carbon Bainitic Steel

352

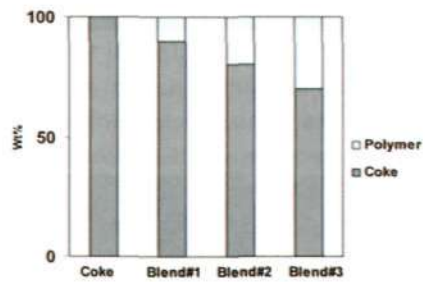


The effect of deformation and cooling rate on microstructural characteristics of a low carbon bainitic steel has been investigated, and the nanohardness of the matrix and the M–A constituents has been characterized. Further, the effect of matrix and M–A constituents on the strength–toughness balance has been studied. It is found that acicular ferrite is the optimum microstructure having a superior strength–toughness balance.

S. Kongkarat, R. Khanna, and V. Sahajwalla

Interactions of Polymer/Coke Blends with Molten Steel at 1823 K: Interfacial Phenomena

EDITOR'S CHOICE 362

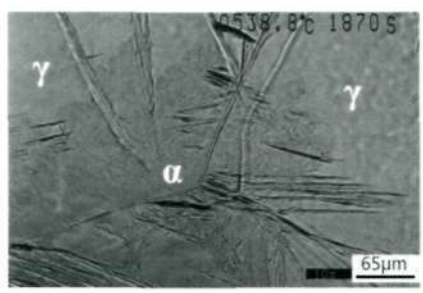


With an aim to utilize waste polymers as a carbon resource in steelmaking, carbon dissolution and interfacial phenomena has been investigated for coke-polymer (HDPE, PET, and bakelite) blends in contact with molten iron at 1550°C. Significant differences are observed in the nature of reaction products deposited at the interface along with small improvements in carbon pick-up by molten iron.

F. J. Ma, G. Wen, and W. Wang

Effect of Cooling Rates on the Second-Phase Precipitation and Proeutectoid Phase Transformation of a Nb–Ti Microalloyed Steel Slab

370

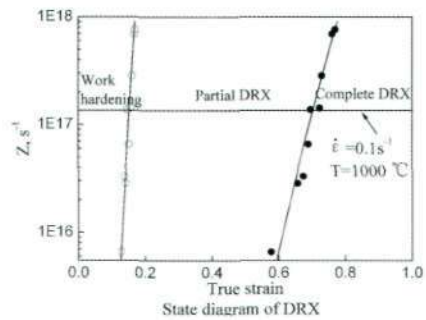


The behavior of the second-phase precipitation is significantly influenced by the cooling rate during the continuous casting of low carbon microalloyed steel. The carbonitrides of microalloying elements acted as inoculant particles to promote the nucleation of the proeutectoid ferrite. The carbon near the grain boundary is depleted when the microalloying elements precipitated into carbonitrides, which promoted ferrite precipitation.

X. Gao, M. Zhu, C. Sun, and G. Fu

Dynamic Recrystallization Behavior and Microstructure Evolution of Bridge Weathering Steel in Austenite Region

377



Dynamic recrystallization (DRX) is an effective means of controlling the steel microstructure evolution and performance during high temperature deformation. The austenite DRX behavior and microstructure evolution of a bridge weathering steel was systematically investigated by using hot compression test and optical microscopy in the paper. The results show factors affecting the kinetics of DRX and microstructure transition during austenite deformation.

Contents

C. Wang, M. Brämming, and M. Larsson

Numerical Model of Scrap Blending in BOF with Simultaneous Consideration of Steel Quality, Production Cost, and Energy Use

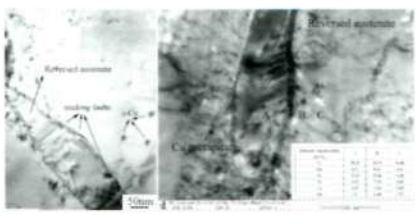
387

The amount of scrap charged into BOF is limited by different factors, such as the scrap availability, composition, properties, and price. The presented paper describes a scrap blending model in combination with an optimization model. Case studies show that the model can be used for optimized steel production with simultaneous consideration of steel quality, production cost, and energy use.

D. Ye, J. Li, W. Jiang, J. Su, and K. Zhao

Formation of Reversed Austenite in High Temperature Tempering Process and its Effect on Mechanical Properties of Cr15 Super Martensitic Stainless Steel Alloyed with Copper

395

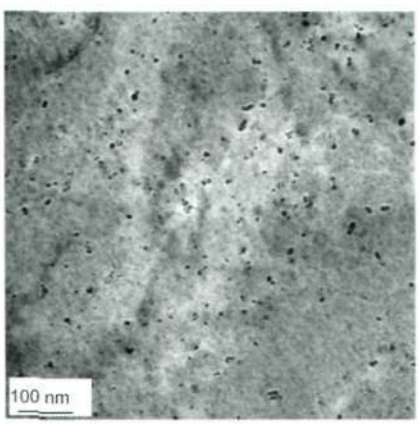


This study investigates the forming and growing up process of reversed austenite in the Cr15 super martensitic stainless steel by means of thermo-calc software, X-ray diffraction, transmission electron microscopy, and high resolution transmission electron microscopy. The experimental results indicate that reversed austenite deeply influenced the mechanical properties.

X. Wang, Y. Zhao, B. Liang, L. Du, and H. Di

Study on Isothermal Precipitation Behavior of Nano-Scale (Nb,Ti)C in Ferrite/Bainite in 780 MPa Grade Ultra-High Strength Steel

402



Ferritic transformation and precipitate nucleation restrict each other due to due to competition for austenitic defects. Bainitic transformation can promote precipitate nucleation. The peak temperature of nano-scale (Nb,Ti) C precipitate is 550°C. When the coiling temperature is 550°C in hot rolling experiments, a large number of <10nm nano-scale (Nb,Ti)C precipitates are obtained (Figure), and precipitation strengthening contribution to reached 325 MPa.