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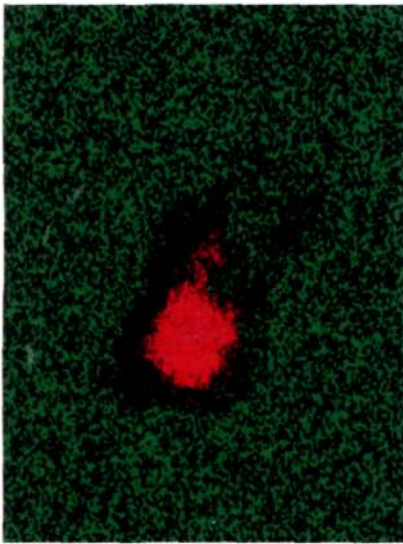
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Cover Photo:

This front cover image reveals the surface vanadium element distribution map of the vanadium rich inclusion particle, which exists in the inner arc of continuous casting by means of SEM surface scanning. More details can be found in the article by M. M. Wu and co-workers on page 534.

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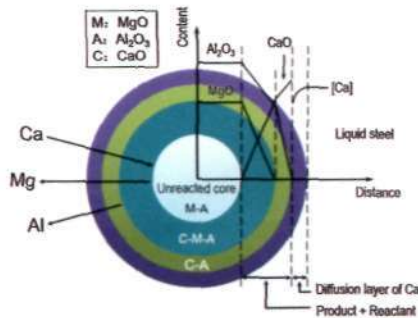
Contents

Full Paper

Z. Deng and M. Zhu

A New Double Calcium Treatment Method for Clean Steel Refining

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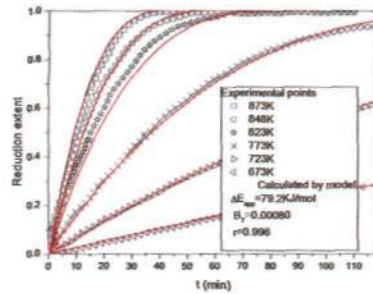


A new double calcium treatment method is proposed according to industrial experiment. In the new process, the evolution of inclusion is analyzed and the controlling standard of $T.[Ca]/T.[O]$ ratio for calcium treatment is discussed. In order to get a good calcium treatment result, $T.[Ca]/T.[O]$ ratio should be controlled above 0.91, and the ratio between 0.91 and 1.25 is suitable in present work.

Contents

J. Dang, K.-C. Chou*, X.-J. Hu, and G.-H. Zhang
Reduction Kinetics of Metal Oxides by Hydrogen

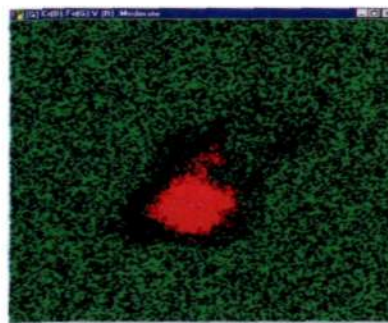
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A new kinetic model has been developed for reduction of metal oxides with hydrogen under both isothermal and non-isothermal conditions. This model can describe the kinetics of single reductive reaction and double reductive reactions by considering the diffusion and chemical reaction controlling mechanisms. The model predicted curves agree well with the experimental results from the literatures.

M. M. Wu*, H. Yu, Y. F. Fan, F. X. Wang, and J. J. Wang
Research of the Continuous Casting Slab Transverse Cracking During Retarded Cooling Process

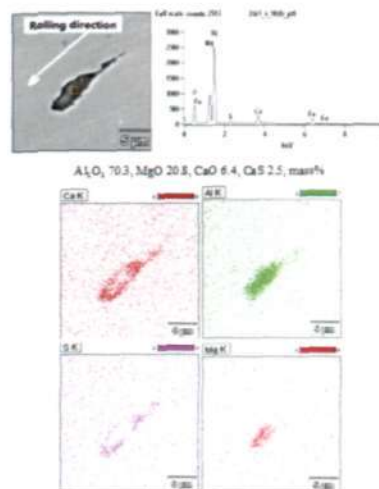
534



The reason of 50Mn2V transverse cracking is studied by a series of means, optical metallographic, SEM for microstructure, fracture surface and inclusions and insitu analysis for element segregation. In summary, internal gas pressure should be the dominant factor that leads the transverse embrittlement of continuous casting blank, while inadequate microstructure, internal stresses, element segregation, and defects play an ancillary role.

J. Guo, S. Cheng, Z. Cheng, and L. Xin
Thermodynamics for Precipitation of CaS Bearing Inclusion and Their Deformation During Rolling Process for Al-Killed Ca-Treated Steel

545



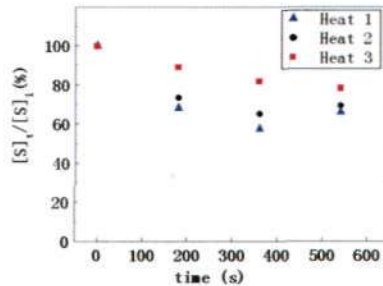
The first type of duplex CaS bearing inclusion forms due to CaS precipitating directly surrounding solid inclusion core; the second type is as modified calcium aluminates react with dissolved sulfur and aluminum. During rolling, the outer CaS rich layer of the first type inclusion is easily separated from the inner core while the later one performs a better deformation.

Contents

F. Jiang, G. Cheng, G. Qian, Y. Xie, Q. Rui, and L. Yang

Evaluation of Sulfur Addition to the High Basicity Slag on the Sulfur, Aluminum, and Cleanliness of High Sulfur Al-Killed Molten Steel

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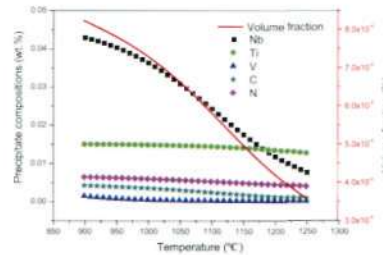


The addition of CaS into slag can reduce [S] loss in the molten steel. At time $t = 360$ s, the sulfur content in the molten steel decreases to $< 60\%$ of the initial sulfur content, when no CaS is added into the slag (Heat 1), but the sulfur content in the molten steel decreases only to 80% of the initial sulfur content, when 5% CaS is added into the slag (Heat 3). The reason may be that after addition of CaS, the content of reaction product CaS in the slag has been increased, which suppressed the desulfurization reaction.

Y. Xu, D. Tang, and Y. Song

Equilibrium Modeling of (Nb, Ti, V) (C, N) Precipitation in Austenite of Microalloyed Steels

560



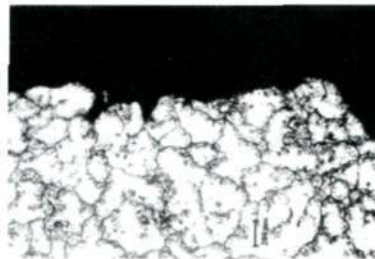
A simple theoretical model which is based on the solubility products of the individual nitrides and carbides was proposed to predict the equilibrium composition of multicomponent precipitates in Nb–V–Ti bearing steel. And the volume fraction of the second phase particles in equilibrium at given temperature can also be obtained by the developed model.

M. O. El-Bealy

Advanced Solute Conservation Equations for Dendritic Solidification Processes Part I: Experiments and Theory

EDITOR'S CHOICE

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Macrosegregation in dendritic equiaxed structure during the early stages of solidification of Al-4.5%Cu alloy has been studied experimentally. The metallurgical study includes macro-microstructure evaluation, measurements of grain size of equiaxed crystals, and macrosegregation analysis. In addition to the experimental work, there is a mathematical study which contains a complete derivation of local solute redistribution equations based on Fleming's approach under different solute diffusion mechanisms in the dendritic solid.

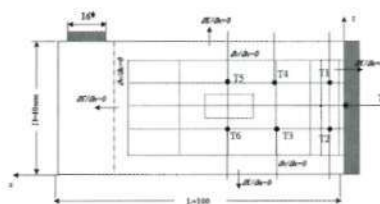
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M. O. El-Bealy

Advanced Solute Conservation Equations for Dendritic Solidification Processes Part II: Numerical Simulations and Comparisons

EDITOR'S CHOICE

584

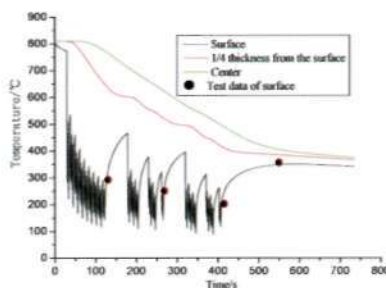


The mathematical model of derived solute equations in Part I for equiaxed dendritic solidification with melt convection streams and thermal is applied numerically to predict macrosegregation distributions in dendritic solid. Numerical and experimental results are present for solidification of a Al-4.5% Cu alloy inside horizontal rectangular cavity at different superheats.

D.-M. Zhu, G.-Y. Liu, S.-J. Zhang, and M.-W. Li

Study of New On-Line Pre-Hardening Technology of 3Cr2NiMo Plastic Die Steel

607



New online pre-hardening equipment for quenching die steel has been developed. Based on the equipment, different online quenching processes of 3Cr2NiMo die steel plate with the thickness of 130 mm were performed by numerical simulation and production experiments. Under the optimal process, the tempering hardness difference was less than 3HRC in the whole 3Cr2NiMo steel plate, and there were no cracks in the steel plate.