steel research international

www.steel-research.de

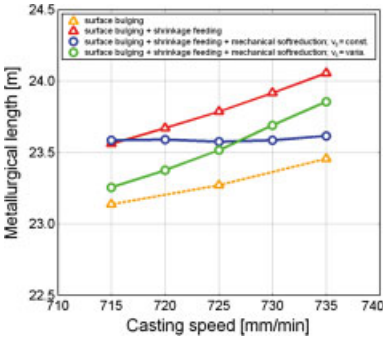
Cover Photo:

The cover image is a schematic for the utilization of hot metal up to 75% of the charge into an industrial scale 150 ton/ch DC-EAF. The steelmaking process parameters are significantly changed with the addition of large amounts of high carbon containing hot metal into the furnace. Oxygen lancing, power input, and tap-to-tap times are some of the essential process parameters that require optimization. For further details see the article by Il Sohn and co-workers on page 302.

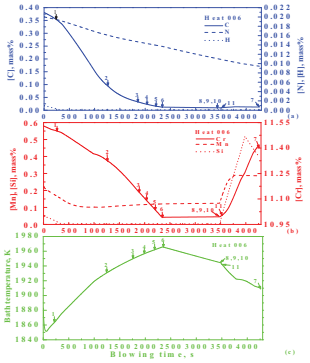
Publishing company:

Wiley-VCH Verlag GmbH & Co. KGaA, Boschstraße 12, D-69469 Weinheim, Germany

Contents



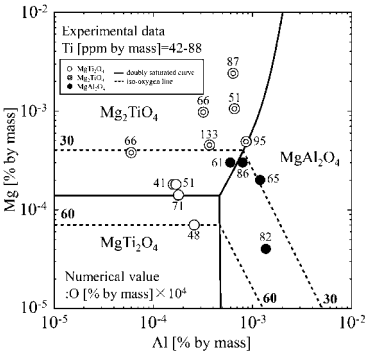
The influence of small casting speed variations (715–735 mm min^{-1}) on the metallurgical length in steel continuous casting is numerically investigated. The numerical simulations are based on an Eulerian two-phase solidification model. For a given casting configuration, the effects of strand surface bulging, shrinkage feeding, and mechanical softreduction are considered in different simulation cases.



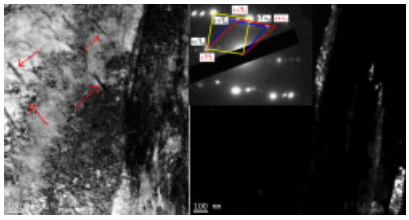
A mathematical model for the combined top and bottom blowing VOD refining of stainless steel is proposed. It is applied to 20 heats of 409L-grade steel refining in a 120 t VOD vessel, good results are obtained. The influences of the related factors and the optimization of blowing technology are examined from the model predictions.

Contents

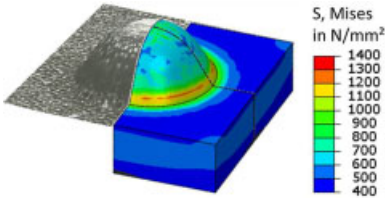
Contents



The relationships of the compounds in the Mg–Ti–Al–O system in equilibrium with molten iron are clarified at temperatures ranging from 1873 to 1973 K, and the thermodynamic calculations are conducted in avoiding Al_2O_3 or spinel $MgAl_2O_4$ formation and for inclusion control. It is shown that the equilibrium relations between those compounds and the composition of solutes in steel at 1973 K.

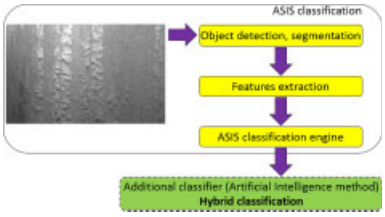


The present study shows that good combination of high tensile strength and relatively high ductility of a microalloyed carbon steel have been attained by quenching–partitioning– tempering process. The experimental results show that the sample partition-tempered for 30 s exhibits best comprehensive mechanical properties, which result from the integrated effect of carbide precipitation, conservation of certain amount of retained austenite and softening of the martensite matrix during the partition–tempering process.

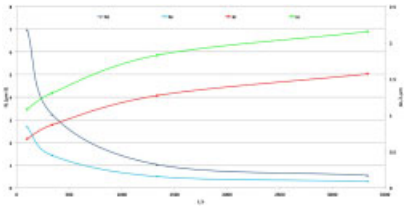


The manufacturing of micro lubrication pockets in stainless steel AISI 304 by hot micro-coining is investigated conducting finite element simulations and complementing experiments. Suitable process parameters and process limits are determined in this work. Process limits occurred for the coining of high strength materials at low process temperatures due to plastic deformation of the die.

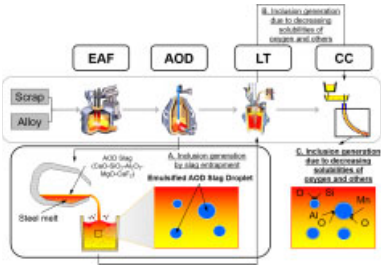
Contents



In this study, a classification model is developed for real-time prediction of various kinds of mill scales at typical hot rolling mill (HRM). In order to obtain input data, the automatic surface inspection system (ASIS) is used together with its classification model. Thereafter, novel procedure is introduced for further boosting of the accuracy of predictions by the use of hybrid classification concept.

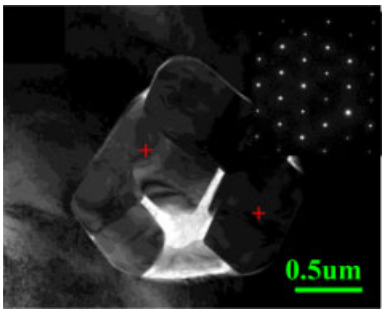


$M_{23}C_6$ particles size, number and dissolution velocity were deduced for tempering of a X20 steel at 800 to 550 °C. The dissolution of small particles increases the particle spacing for above one order of magnitude more than particles coarsening. By creep tests above 550 °C, particles spacing and creep rate are increased significantly by dissolution of small particles.

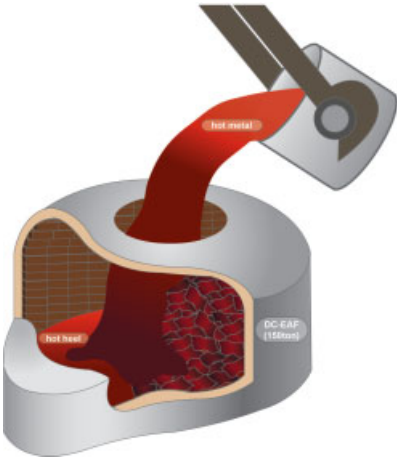


Composition evolution and number density of oxide inclusions in austenitic stainless steel during continuous casting are demonstrated by plant data as well as mathematical modeling. Origin of the inclusions is argon oxygen decaburization (AOD) slag, and the inclusions grow by subsequent oxide formation due to decrease of solubility limit of O, Al, Mn, Si, etc, during casting. A simple mathematical model is presented to account for the composition evolution.

Contents



A novel method to synthesize Mo_2NiB_2 boride cermet coating on Q235 steel substrate, consisting of Mo_2NiB_2-type ternary boride as a reinforced phase and a γ-(Fe, Ni) base binder, is realized with laser cladding technique. The wear resistance of the Q235 substrate is greatly improved. As compared to 304 stainless steel, lower corrosion rate is obtained for the coating and pitting corrosion disappeare in particular.



Hot metal additions into a 150 ton DC-EAF is studied. 1700 kWh of accumulated power consumption is decreased for every ton of hot metal utilized. Oxygen lancing practices is modified with hot metal additions in the EAF without increasing the tap-to-tap times. At hot metal additions of above 0.6, the decarburization rate linearly increases with oxygen lancing.