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Editorial

Continuous Casting

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1. Introduction and Scope

Continuous casting is a process whereby molten metal is solidified into a semi-finished billet, bloom, or slab for subsequent rolling in finishing mills; it is the most frequently used process to cast not only steel, but also aluminum and copper alloys. Since its widespread introduction for steel in the 1950s, it has evolved to achieve improved yield, quality, productivity, and cost efficiency. It allows lower-cost production of metal sections with better quality, due to the inherently lower costs of continuous, standardized production of a product, as well as providing increased control over the process through automation. Nevertheless, challenges remain and new ones appear, as methods are sought to minimize casting defects and to cast alloys that could originally only be cast via other means. This Special Issue covers a wide scope in the research field of continuous casting.

2. Contributions

Fourteen research articles have been published in this Special Issue of *Metals*. Twelve of these [1–12] relate to the continuous casting of steel, a general schematic for which is shown in Figure 1. As is evident from this figure, the overall process consists of a ladle and a tundish through which molten steel passes, a cooling mould region where solidification starts and at which electromagnetic stirring (EMS) may be applied, secondary cooling regions where water is sprayed on the solidified steel, a so-called strand electromagnetic stirrer, a further region at which final EMS is applied, and withdrawal rollers, by which point the steel has completely solidified. In addition, Figure 2 shows which stage of the continuous casting process each of the articles has focused on.

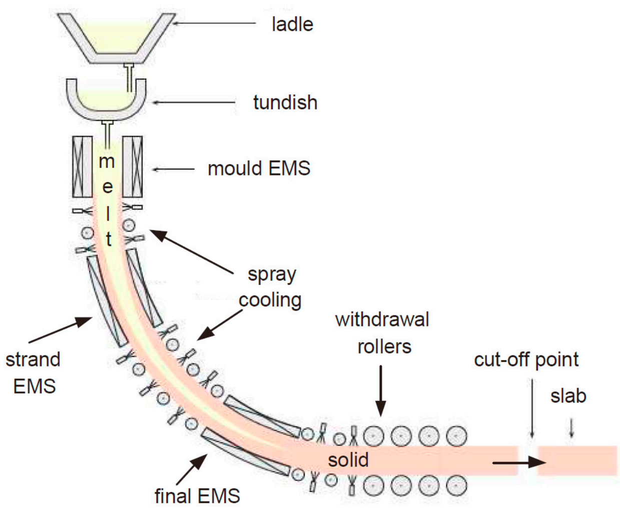

Figure 1. Schematic for the continuous casting of steel.

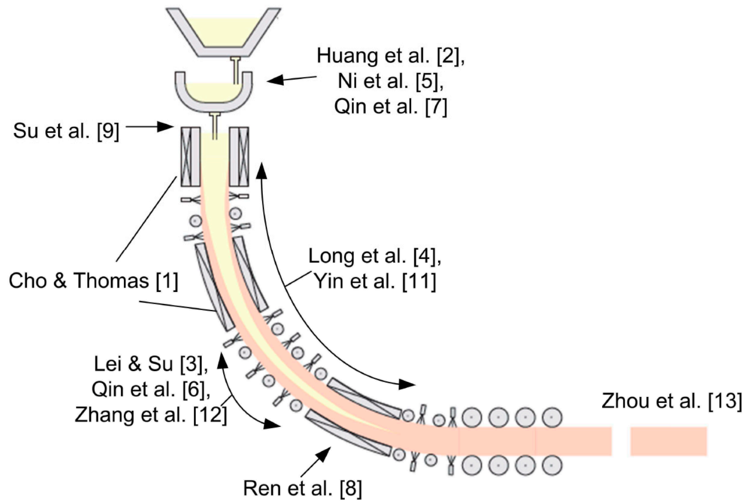

Figure 2. Schematic relating the articles in this special issue to the continuous casting of steel.

Commencing from the start of the process and working downwards [2,5,7], it is important to consider flow in the tundish. Huang et al. [2] use particle image velocimetry (PIV) and numerical simulation to investigate the flow characteristics for a two-strand tundish in continuous slab casting. On the other hand, Ni et al. [5] present a numerical study on the influence of a swirling flow tundish on multiphase flow and heat transfer in the mould, whereas Qin et al. [7] conduct a simulation study on the flow behavior of liquid steel in a tundish with annular argon blowing in the upper nozzle. Su et al. [9] use machine-learning techniques for mold-level prediction by means of variational mode decomposition and support vector regression (VMD–SVR), whereas Cho and Thomas [1] review the literature on electromagnetic forces in continuous casting of steel slabs. Yin et al. [10] consider modelling on inclusion motion and entrapment during full solidification in a curved billet caster, while Long et al. [4] develop a combined hybrid 3-D/2-D model for flow and solidification prediction during slab continuous casting. Qin et al. [6] perform an analysis of the influence of segmented rollers on slab bulge deformation, while Lei and Su [3] use machine learning in the research and application of a rolling gap prediction model. Zhang et al. [11] devise a laboratory experimental setup and consider heat transfer characteristics during secondary cooling, whereas Ren et al. [8] carry out numerical simulations of the electromagnetic field in round bloom continuous casting with final electromagnetic stirring. Zhou et al. [12] consider control of upstream austenite grain coarsening during the thin-slab cast direct-rolling (TSCDR) process, after complete solidification has occurred.

Aside from all of the above, Yang et al. [13] simulate crack initiation and propagation in the crystals of a continuously-cast beam blank, whereas Vynnycky [14] gives a review of applied mathematical modelling of continuous casting; this considers a hybrid of analytical and numerical modelling with an emphasis on the use of asymptotic techniques, and gives examples of problems not only in the continuous casting of steel, but also that of copper and aluminum alloys.

3. Conclusions and Outlook

A variety of topics have composed this Special Issue, presenting recent developments in continuous casting. Nevertheless, there are still many challenges to overcome in this research field and applications still need to be more widespread. As a Guest Editor, I hope that all of the scientific results in this Special Issue contribute to the advancement and future developments of research on continuous casting.

Finally, I would like to thank all reviewers for their invaluable efforts to improve the academic quality of published research in this Special Issue. I would also like to give special thanks to all staff at the Metals Editorial Office, especially to Toliver Guo, Assistant Editor, who managed and facilitated the publication process.

Conflicts of Interest: The author declares no conflicts of interest.

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