Preface

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Published online: 1 August 2018
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Steels, the most widely used metals in the world, play fundamental and crucial roles in various industries as well as our daily life. It is well known that the performance of materials is correlated with designed composition and achieved structures that are controlled by process procedures and parameters, and thus the employment of proper procedures and parameters is essential for the properties and quality of final steel products. Solidification is a key step in the steel manufacturing route. Once the solidified steel billets or ingots contain detrimental defects, such as macrosegregation, it is difficult to eliminate them by the subsequent rolling and heat treatment procedures. Therefore, proper control of solidification processes produces high-performance steel products. Moreover, it has been recognized that the application of advanced casting technologies, such as continuous casting and thin slab/strip casting, can significantly increase the production efficiency as well as energy saving. Hence, developing new and advanced casting and solidification technologies provides a potentially feasible approach in steel green manufacturing.

In order to deeply understand and precisely control the solidification process to achieve designed structures of steel billets and ingots, the Center for Advanced Solidification Technology (CAST), affiliated with Shanghai University, is devoted to investigating the solidification-relevant fundamental theories of steels, and developing the advanced solidification technologies and associated setups or equipments to eventually achieve the green manufacturing of the high-quality steel. The present special issue is composed of 12 articles from the CAST with respect to solidification processes and solidified structures of steels.

Three articles are related with the technology of pulsed magneto oscillation induced grain refinement, two articles with the solidification process of steel ingot using thermal and numerical simulations, one article with the results of the low-density steel prepared by sub-rapid solidification, three articles with the precipitation of inclusions in steels, two articles with the microstructures of steel welding joint, and one article with developing concept of new materials combining the high-entropy alloy and steel.

Professor Qi-jie Zhai the guest editor of this special issue, is the director of Center for Advanced Solidification Technology at Shanghai University. His research focuses on solidification theory of metals and techniques for solidification structure refinement. Based on the fundamental research, he has developed many original techniques with respect to structure control for metal solidification, such as structure refinement caused by pulsed magneto-oscillation, thermal simulation method for solidification process, metastable phase engineering materials prepared by sub-rapid solidification, etc. In addition, 11 related techniques have been applied in industry. Prof. Zhai has published more than 400 papers and 2 monographs. Prof. Zhai was awarded with a National Award for Technological Invention (because of improvement of macro-segregation in continuous casting slabs) and other 9 Ministerial and Provincial-Level Science and Technology Awards.

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