Preface

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Accepted: 22 October 2021 / Published online: 10 November 2021
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Electroslag remelting (ESR) is a process of remelting and refining steel and other alloys for mission-critical applications in aircraft, thermal power stations, nuclear power plants, military technology, etc. The ESR process uses the as-cast alloy as a consumable electrode. The passage of an electric current from the consumable electrode to the baseplate creates enough Joule heating in the highly resistive calcium fluoride-based slag that is sufficient to melt the consumable electrode. The interaction between the self-induced magnetic field and the electric current gives rise to the Lorentz force. Metal droplets travel through the slag to the bottom of the water-cooled mold and slowly freeze as the ingot is directionally solidified upwards from the bottom of the mold. The molten slag pool floats above the refined ingot, continuously floating upwards as the ingot solidifies. The molten metal is cleaned of impurities that chemically react with the molten slag or otherwise float to the top of the molten pool as the molten droplets pass through the molten slag layer.

Except for high-quality alloys, ESR has been extended to the field of resource recovery. Furthermore, a series of new technologies in the family of ESR have been developed in recent years such as electroslag continuous casting,

conductive mold, electroslag liquid pouring, and pressurized/protective atmosphere electroslag remelting. Meanwhile, many excellent achievements have been produced in the electroslag metallurgy fields such as slag optimization, alloying element control, solidification structure regulation, and numerical simulation. Increasing attentions from smelters and researchers have been obviously paid to ESR.

In this trend, a special issue for the *Journal of Iron and Steel Research International* focused on ESR has been organized. We hope that this special issue could be helpful to the scholars and smelters who are committed to ESR.

Wan-ming Li the guest editor of this special issue, is an associate professor of Metallurgical Engineering at University of Science and Technology Liaoning, China. He was a visiting scholar at Colorado School of Mines in 2020. His research interests include electroslag remelting theory and technology, quality control of special steel, numerical simulation of metallurgical process, etc. In recent years, he has published more than 30 peer-reviewed

papers, hosted two National Natural Science Foundation of China projects and participated in four National Natural Science Foundation of China projects. In 2020, he was appointed to the youth editorial board of *Journal of Iron and Steel Research International* and *Journal of Iron and Steel Research*. His research mainly focuses on the solidification quality control of electroslag remelting ingot.

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rial Science and Engineering, Delft University of Technology from 2018 to 2020 as a postdoctoral. Dr. Qiang Wang is interested in the development of CFD models and optimization strategies applied to fluid flow, heat and mass transfer of ESR processes. He has also extended the traditional ESR technology to recycling of rejected metal scrap. Dr. Qiang Wang has published more than 60 papers and 1 monograph, and has obtained 15 Chinese patents related to ESR so far.

Cheng-bin Shi the guest editor of this special issue, is an associate professor, deputy director of Institute of Advanced Steel, University of Science and Technology Beijing, China. He obtained his Ph.D. degree in Metallurgical Engineering in January 2013 from the University of Science and Technology Beijing, China. He held a post-doctoral research position at Pohang University of Science and Technology from 2013 to 2014. His research is focused on

electroslag remelting towards special steel, tool steel, and heat-resistant steel. He was awarded three provincial and ministerial science and technology awards. He has authored over 60 peer-reviewed papers, two English monographs (*Electroslag Remelting Towards Clean Steel* and *Carbide in Special Steel: Formation Mechanism and Control Technology*), and three review papers regarding deoxidation, desulfurization and inclusions.