Special Issue

Sustainable Ironmaking and Steelmaking: Challenges and Opportunities

Message from the Guest Editor

The iron and steel industry is a cornerstone of global industrialization. As climate change mitigation becomes increasingly urgent, the development of sustainable ironmaking and steelmaking technologies has emerged as a critical priority. This Special Issue focuses on the latest advancements and innovations in low-carbon metallurgy and intelligent metallurgy. Low-carbon metallurgy encompasses both the optimization of traditional integrated steelmaking routes and the adoption of breakthrough short-process technologies. For the conventional blast furnace-basic oxygen furnace (BF-BOF) route, key strategies include oxygenenriched operation together with top gas recycling. hydrogen reduction, the utilization of low-carbon ferrous burden, carbon capture and utilization (CCU), and using alternative carbon sources such as biomass. Meanwhile, short-process routes, such as hydrogen-based direct reduction (H₂-DRI) coupled with electric arc furnaces (EAFs), are gaining traction as they significantly reduce reliance on fossil fuels. In parallel, intelligent metallurgy is revolutionizing the industry through integrating artificial intelligence (AI), big data, and advanced automation.

Guest Editor

Prof. Dr. Yanbing Zong

School of Metallurgical and Ecological Engineering, University of Science and Technology Beijing, Beijing 100083, China

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Metals
Editorial Office
MDPI, Grosspeteranlage 5
4052 Basel, Switzerland
Tel: +41 61 683 77 34
metals@mdpi.com

mdpi.com/journal/ metals





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Message from the Editor-in-Chief

Metallic materials play a vital role in the economic life of modern societies; contributions are sought on fresh developments that enhance our understanding of the fundamental aspects related to the relationships between processing, properties and microstructure – disciplines in the metallurgical field ranging from processing, mechanical behavior, phase transitions and microstructural evolution, nanostructures, as well as unique metallic properties – inspire general and scholarly interest among the scientific community.

Editor-in-Chief

Prof. Dr. Yong Zhang

Beijing Advanced Innovation Center of Materials Genome Engineering, State Key Laboratory for Advanced Metals and Materials, University of Science and Technology Beijing, 30 Xueyuan Road, Beijing 100083, China

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