2025 AIST-TMS John F. Elliott Lecture

Achieving CO_2-Free Steelmaking: Pathways and Challenges

The steel industry plays a crucial role in global efforts to reduce greenhouse gas emissions in line with the 2015 Paris Agreement. Transitioning to CO_2-free steel production involves three key technological pathways. The Circular Economy approach enhances sustainability by maximizing material recovery and increasing steel scrap recycling. Smart carbon use focuses on optimizing existing steelmaking processes through process integration and utilizing captured CO/CO_2 for valuable products via carbon capture and utilization. Carbon direct avoidance seeks to eliminate CO_2 emissions by replacing fossil fuels with electric energy and hydrogen from renewable energy, mainly focussing on virgin iron ore processing.

However, the shift to zero-carbon steel presents significant challenges, including high investment costs, infrastructure demands, and the availability of essential resources such as green electricity, hydrogen, and high-quality scrap. Overcoming these barriers is critical to ensuring a sustainable future for the steel industry.

Contact

Johannes Schenk

Montanuniversität Leoben, Austria

johannes.schenk@unileoben.ac.at

Biography

Johannes Schenk holds a Ph.D. in process engineering from the Graz University of Technology. He started his career in 1990 at Voestalpine Industrieanlagenbau (now Primetals Technologies Austria) as a process and research engineer focusing on alternative ironmaking technologies such as MIDREX, COREX and FINMET. From 1992 to 2007, he was general manager and vice president of R&D, leading the development of the FINEX process.

Since 2008, Schenk has been a full professor of ferrous metallurgy at the Montanuniversität Leoben. From 2015 to 2023, he was also chief scientific officer of the Austrian metallurgical competence centre K1-MET GmbH.

His research focuses on primary steelmaking technologies, in particular ironmaking and crude steel production. Current projects focus on CO_2-reduced steelmaking and recycling. Schenk has authored more than 180 papers in peer-reviewed journals and conference proceedings and is an inventor or co-inventor on more than 30 patent families.

The AIST-TMS John F. Elliott Lectureship was established in 1990. This honorary lectureship is designed to acquaint students and engineers with the exciting opportunities in chemical process metallurgy; inspire them to pursue careers in this field; inform the public of the contributions of chemical process metallurgy and materials chemistry to the association; and honor the late Prof. John Elliott of the Massachusetts Institute of Technology for his many accomplishments and the leadership that he provided during his career.