Contribution ID: **40** Type: **Oral Presentation - Full Paper will be submitted**

Numerical Modeling of Hydrogen Electric Arcs for Optimizing Green Steel Production in EAF

Wednesday, 21 May 2025 14:40 (20 minutes)

The Electric Arc Furnace (EAF) significantly reduces carbon emissions in steel production by utilizing electricity instead of traditional fuels, especially when powered by renewable energy sources. This reduction is further enhanced through the adoption of green hydrogen technology, which replaces carbon-based reduction processes with hydrogen, resulting in an almost carbon emission-free operation. In this context, hydrogen, combined with inert gases, acts as a reducing agent for iron oxides within the EAF. Understanding the behavior of electric arcs in hydrogen-rich atmospheres is therefore critical for scaling hydrogen-based technologies to industrial levels.

In this study, we present a three-dimensional numerical model designed to simulate hydrogen electric arcs. The model integrates electromagnetic field dynamics with the behavior of hydrogen plasma arcs, focusing on flow characteristics and heat transfer under atmospheric pressure and a direct current (DC) power supply. The simulations reveal the transient and unstable characteristics of hydrogen arcs compared to traditional arcs operating in air or argon. This model enhances the understanding of arc behavior and provides insights to predict and mitigate potential failures during operation, contributing to the optimization of hydrogen-integrated EAF processes.

Speaker Country

Austria

Are you interested in publishing the paper in a Steel Research International special issue?

Yes

Primary authors: AL NASSER, Mohamad (Montanuniversität leoben); KHARICHA, Abdellah (Montunivesität leoben); WU, Menghuai (Montanuniversitaet Leoben); KARIMI SIBAKI, Ebrahim (Montanuniversitaet)

Presenters: AL NASSER, Mohamad (Montanuniversität leoben); KHARICHA, Abdellah (Montunivesität leoben)

Session Classification: CO2 mitigation in iron and steelmaking

Track Classification: CO2 mitigation in iron and steelmaking