Contribution ID: **12** Type: **Oral**

Investigation of the smelting and carburization behavior of DRI-Pellets under an inert atmosphere using various carburization agents.

Thursday 9 October 2025 14:00 (20 minutes)

Carburization during the smelting of direct reduced iron in a smelter is critical in achieving the desired hot metal properties for refining in a steel plant. This study investigates DRI's smelting and carburizing behavior, focusing on the interaction between slag and carburization agents of differing grain sizes. The key objectives include achieving a high carbon content in the hot metal, examining the dissolution behavior of carbon in DRI-based smelts, and maintaining a specific slag basicity. The effects of increasing slag heights and element interactions on carbon dissolution were also analyzed. The experiments were conducted using a 60 kW vacuum induction furnace under an inert atmosphere at a constant pressure of 0.9 bar. A comprehensive setup allows semicontinuous material feeding, sample extraction, and video documentation of smelt behavior. Neutral-gas-reduced-DRI pellets were combined and charged with various carburization agents and lime in a base smelt with 2 weight-% carbon. The carburization agents include lignite coke, coke breeze, and bio-based carbon in 4–2 mm grain sizes and 2–1 mm. Analysis of the samples and the regulus showed an average carbon content of 4 weight-% in the regulus. The increasing slag volume influenced both the dissolution behavior of the carburization agents and the DRI. A pressure increase in the furnace chamber, attributed to CO/CO2 generation during reduction, was managed through repeated evacuations. The target slag basicity wasn't achieved due to elevated MgO content from crucible materials and insufficient reaction time. The findings underline critical best practices in optimizing carbon dissolution and slag management. The results visualize strategies for producing high-quality DRI-based hot metal.

Primary author: Mr KIPP, Daniel (Universität Duisburg-Essen)

Co-authors: Mr KARAGÜLMEZ, Gökhan (Universität Duisburg-Essen); Dr JÄGER, Nils (thyssenkrupp Steel Europe AG); Prof. DEIKE, Rüdiger (Universität Duisburg-Essen)

Presenter: Mr KIPP, Daniel (Universität Duisburg-Essen)

Session Classification: Smelting & Carburization Technologies

Track Classification: Ironmaking - Direct reduction and smelting reduction