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Circored as a Pre-Reduction Step for Low-Grade Iron Ores

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The steel industry is actively seeking innovative technologies to significantly reduce carbon footprints, especially for low-grade iron ores (BF quality), which constitute the majority of available iron ore resources and are primarily processed through the blast furnace route. The Circored process, developed by Metso, utilizes fluid bed reactors for the direct reduction of iron ore fines (instead of pellets) with hydrogen and has demonstrated its efficacy at an industrial scale for high-grade DR quality ores. This paper elaborates on the potential of a simplified Circored process as a pre-reduction step in sustainable steel production, focusing on its application to low-grade iron ores. A single-stage Circored process aims to reduce the ore to a metallization degree of approximately 80%. This semi-reduced direct reduced iron (DRI) can be further processed in smelting furnaces for final reduction, gangue separation, and carburization. This integrated approach is particularly suitable for low-grade iron ores with high gangue and loss on ignition (LoI) contents, which cannot be treated in EAF due to the resulting large slag formation and are often also challenging to pelletize.

Studies and test results from Metso's R&D center in Frankfurt confirm the feasibility of the Circored process for low-grade iron ores, achieving targeted metallization degrees of 75-85% with various BF-grade ores. The paper also outlines a roadmap for using Circored as a pre-reducer to decarbonize iron production, including transitional strategies like Low Reduced Iron (LRI) injection into blast furnaces and mid-term strategies involving LRI in electric smelters. In conclusion, the Circored process as a pre-reduction step offers a sustainable solution for steel production from low-grade iron ores. By reducing carbon emissions and utilizing abundant low-grade resources, the Circored process addresses the environmental and economic challenges of traditional steelmaking methods. This innovative approach aligns with global efforts to achieve carbon neutrality.

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