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Safe H-DRI: advancing the production, transport and storage of Hydrogen-based Direct Reduced Iron (H-DRI) for sustainable steelmaking

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The transition to hydrogen-based direct reduction (H-DRI) is a crucial step in decarbonizing the steel industry. The 'Safe H-DRI' project aims to optimize the production, loading, transport, unloading and storage of Hyrogen-based-DRI (H-DRI), addressing key challenges related to its stability, metallurgical properties, and industrial applicability.
This study investigates the hydrogen-based reduction on iron ore pellets, followed by the evaluation of physical and chemical properties of H-DRI, assessing its oxidation resistance with passivation methods, chemical and mechanical stability, and handling safety during storage and transport. Special attention is given to reoxidation risks, as H-DRI is highly reactive due to its large surface to volume ratio. Various passivation techniques and controlled atmosphere storage solutions are evaluated to investigate and understand the effects and reactions to better prevent degradation and ensure safe long-distance transport.
Furthermore, the research explores the potential and creates feasibility of the expected increase of the utilization of lower-grade iron ores, to improve sustainability and resource efficiency, while also the development of strategies for reusing fines and loss material during handling of H-DRI, with the aim of minimizing waste and supporting circular economy.
The findings are expected to provide crucial insights into safe handling strategies and operational best practices for large-scale H-DRI deployment, contributing to the development of a hydrogen-based steel industry aligned with the European Union's goal for 2050.
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