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Volteron™: Scalable Electrochemical Ironmaking for Carbon-Free Steel Production

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With growing regulatory pressure and the need to achieve net-zero targets, new technologies for 'low carbon' steelmaking are being urgently explored. Volteron™, developed by the John Cockerill Group and ArcelorMittal Group, introduces a novel electrochemical ironmaking route based on low-temperature electrowinning of iron oxide. The technology eliminates direct CO_2 emissions and leverages renewable electricity to produce high-purity iron plates ready for downstream use in electric arc furnaces (EAFs).
This paper presents the scientific and engineering principles of the Volteron™ process, covering its ore preparation, electrolytic cell architecture, and product handling. It describes the pilot plant commissioned in April 2025 and outlines the technology's industrial roadmap, which is built around modular capacity scaling. Comparative analysis with hydrogen-based direct reduction (H_2-DRI) technologies is provided to highlight Volteron's advantages in terms of emissions, energy efficiency, scalability, and time-to-market.
Supported by a legacy of electrowinning technologies from the copper and zinc industries, Volteron™ offers a reliable and adaptable solution for decarbonizing steelmaking. With a demonstrated energy demand <3.75MWh/t and zero CO_2 emissions under renewable operation, this process could account for up to 14% of global steel production by 2050, according to IEA projections. The findings confirm Volteron's potential as a cornerstone of a sustainable metallurgical future and and a facilitator of the EAF decarbonisation.

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