

La Métallurgie, Quel Avenir ! (8-12 Avril 2019, Nancy)

Decarbonisation of Primary Steel production by Deep Electrification

Hervé Lavelaine^{1,*}, ΣIDERWIN partners²

¹ArcelorMittal Maizières

² <https://www.siderwin-spire.eu/>

*Correspondence: herve.lavelaine@arcelormittal.com; Tel.: 06 21 46 40 95

Keywords: Steel production; Electrolysis; Decarbonisation, Climate Change

The steel industry generates between 7 and 9% of direct emissions from the global use of fossil fuel [1]. It operates highly efficient processes and is considered difficult to decarbonize. However, the competitive deployment of renewable electricity might provide an opportunity for the decarbonisation of a portion of industry, through the direct use of electricity. Deep electrification of iron production could provide a contribution to the abatement of the overall GHG emissions [2]. To these regards, H2020-ΣIDERWIN project proposes to develop a breakthrough innovation compared to the actual steel production process bringing together steel making with electrochemical process. By assuming that no genuine environmental improvement is possible without significant reduction of the amount of energy exchanged, the electrolytic process is designed and engineered to follow the thermodynamic route of least energy involvement between iron oxide and iron metal. This process has been gradually up scaled from workbench experiments at TechnicalReadinessLevel1 to laboratory pilot at TRL4 during the ULCOS project (2004-2010) and later projects such as RFCS-IERO, ANR-ASCoPE and ADEME-VALORCO. It is based on the electrowinning of iron in alkaline solution at 110°C [3]. Now in the ΣIDERWIN project, a pilot of TRL6 is built to address the development of the key components of the technology and to operate in a relevant environment. The anticipated conditions to access to cheap iron oxide and electricity call to reinforce the ability of the process to treat non-ferrous metallurgy residues and to operate flexibly.



Figure: ΣIDERWIN pilot drawing.

References

- [1] <https://www.worldsteel.org>
- [2] https://ec.europa.eu/info/publications/final-report-high-level-panel-european-decarbonisation-pathways-initiative_en
- [3] Boyan Yuan and G.-M. Haarberg , Electrowinning of Iron in Aqueous Alkaline Solution Using Rotating Disk Electrode, DOI: <https://doi.org/10.1051/metal/2009078>