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ZHyRON project: Valorization of iron-rich & Zinc-containing steelmaking by-products via Hydrogen-based Reduction

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Problem and significance
Existing valorization processes for the treatment of Fe-rich and Zn-containing steelmaking by-products or wastes need a source of heat and a reductant. In most cases a fossil fuel like coal, coke or natural gas is used. The large rate of fossil fuels/reductants needed make pyrometallurgical processes very intensive in terms of CO2 emissions. Following the aim of the European Green Deal to make Europe climate neutral by 2050, one of the routes proposed is to move from carbon-based processes to hydrogen-based applications. Accordingly, to make the steel industry more CO2 neutral and achieve the zero wastes goal, new circular economy solutions must be developed and validated before their industrial implementation.

Solution
To tackle these challenges in the recycling of key steelmaking by-products, while minimizing CO2 emissions, ZHyRON will develop an innovative valorization route using green H2 as reductant together with green electricity as energy source. Fe-rich Zn-containing by-products will undergo pyrometallurgical and hydrometallurgical treatment to separate Fe and Zn. Within ZHyRON, the iron oxides units will be recovered as direct reduced iron able to be consumed in electric arc furnaces while the zinc will be recovered as zinc oxide concentrate with enough purity to be externally valorized by a zinc smelting company and/or used for other applications. The process water will be treated by waste heat driven membrane distillation and reused for H2 production. The ZHyRON route will contribute to circular economy and industrial symbiosis for long-term goal towards zero-waste.
The proposed technologies will be developed and endorsed at lab pilot scale, and the obtained DRI products will be validated in the steelmaking value chain by small scale smelting trials to assess the impact in the EAF process. In the current work, an updated summary of the activities already carried out will be provided.

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