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Models for simulating gas and energy management in the transition of integrated steelworks to high hydrogen direct reduction-based processes

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Integrated steelworks are deeply affected by the decarbonization transition of the steelmaking sector required by the European Green Deal. One of the most promising solutions is their conversion from blast furnace-basic oxygen furnace based plants to direct reduction shaft furnace-electric arc furnace based routes using hydrogen enriched reducing gases. However, this conversion involves challenges ranging from the micro (i.e. at particle level) to the macro (i.e. plantwide) scale. Issues are expected especially in the transition period, where processes belonging to two production routes will coexist. Currently conventional integrated steelworks are close to an optimum point and are almost self-sufficient from the energetic point of view. On the contrary, during the transition, existing equilibria will be troubled from the point of view of production and gas and energy management. Therefore, solutions must be proposed to smoothly guide the transition enabling optimal gas and energy management in the different stages and supporting environmental and economic sustainability. The project entitled "Maximise H2 Enrichment in Direct Reduction Shaft Furnaces"(ref. MaxH2DR, G.A. 101058429), which is co-funded by the European Union through the Horizon Europe programme, is developing a multipurpose simulation toolkit including, among others, models of gas and energy management units in conventional integrated steelworks, and of main direct reduction processes including gas management units that are well integrated in these processes. Such models will be used to investigate transition scenarios starting from a European integrated standardized steel mill considering also the issues related to the gas and energy management. The proposed contribution focuses on these models and their application.

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