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Advances in Ironmaking and Steelmaking Processes

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In recent years, ironmaking and steelmaking have witnessed the incorporation of various new processes and technologies that can be operated and organized in different combinations depending on the properties of raw materials and the required quality of the final products. Indications from the steel industry and local and global government institutions suggest that the breakthrough technologies for decarbonization will be based on new fuels and energy vectors. For CO₂-lean process routes, three major solutions have been identified: decarbonizing, whereby coal would be replaced by hydrogen or electricity in the hydrogen reduction or electrolysis of iron ore processes; the introduction of CCS technology; and the use of sustainable biomass.

Today, hydrogen-based steelmaking is a potential low-carbon and economically attractive route, especially in countries where natural gas is cheap. By considering systems for increasing energy efficiency and reducing the environmental impact of steel production, CO₂ emissions may be greatly reduced by hydrogen-based steel production if hydrogen is generated by means of carbon-free and renewable sources. Currently, the development of the hydrogen economy has received a great deal of attention in that H₂ is considered a promising alternative to replace fossil fuels. Based on hydrogen, the “hydrogen economy” is a promising clean energy carrier for decarbonized energy systems if the hydrogen used is produced from renewable energy sources or coupled with carbon capture and storage (CCS) or nuclear energy.

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