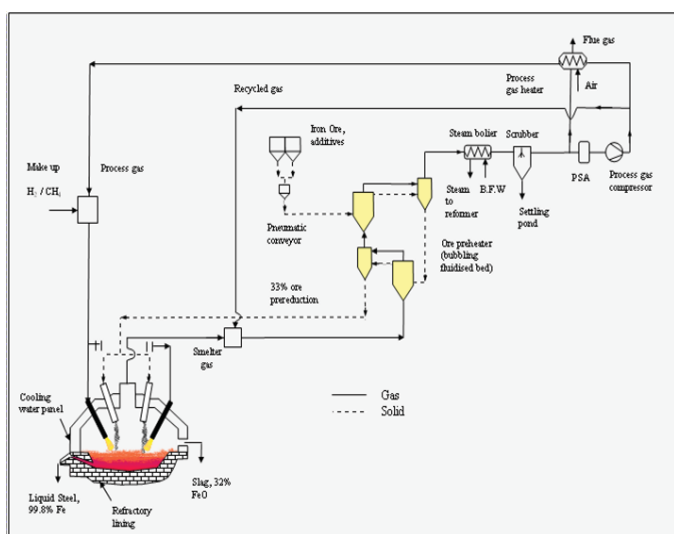


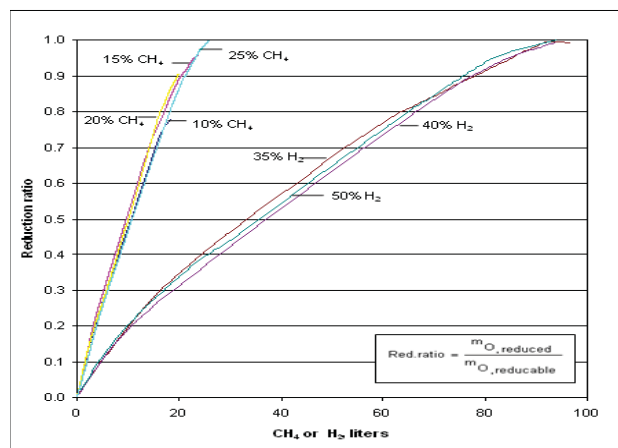
# Plasma smelting reduction of iron ores by hydrogen rich gases

The aim of the present work is to deepen our understanding of hydrogen plasma as an alternative to conventional steelmaking processes. The scale-up potential has been studied and further experimental work completed.



After the Kyoto agreement, it became necessary to find innovative technologies to decrease CO<sub>2</sub> emissions produced by the steel industry. As a low CO<sub>2</sub> emissions process, a flowsheet has been introduced to show the scale-up potential of plasma smelting reduction by hydrogen rich gases. The process showed competitive advantages in terms of environmental aspects, shorter steelmaking process and efficient processing of various grade ores. However, the process has been described as a futuristic process due to the lack of mature experimental results (pilot scale), relatively high consumption of electricity and high cost of hydrogen.

In some of the conducted test runs, methane gas was mixed with argon to evaluate the contribution of the methane cracked products to the reduction of iron oxide. It was found that methane reduction is about 4 times faster than hydrogen due to the carbon conversion during reduction into carbon monoxide. Although the emitted CO<sub>2</sub> in the methane application is higher than that of hydrogen, the scaled-up process is advantageous as it has a lower gas volume and lower capital/running costs.



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## Research Work

- Evaluation of the process scale-up potential
- Influence of gases (CO, CO<sub>2</sub> and H<sub>2</sub>O) on the kinetics of hydrogen plasma reduction
- Plasma smelting reduction of iron oxide by methane-argon gas mixture
- Reduction behaviour of pre-reduced ore
- Thermodynamic calculations of oxygen and hydrogen solubility in metal and slag

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