DRI Production Using Hydrogen

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The use of hydrogen for direct reduction is not new. HYL proposed a feasible solution in 1980…

About 70 years ago, Hylsa-Mexico was urged to find an alternative raw material for steel production. After trying unsuccessfully some existing processes. Hylsa decided to carry out a research program to develop its own direct reduction technology, which took advantage of existing petrochemical plants concepts replacing distillation columns by direct reduction reactors. The key component of such plants was the natural gas/steam reformer.

From 1957 to 1968, all industrial DR plants operating worldwide were based on the HYL process. The first Midrex plant, based on a natural gas/CO_2 reformer, started up until 1969. Standard Midrex plants operate today with a H_2/CO ratio of 1.5/1.0 whereas HYL plants (based on reformed gas) yield a H_2/CO ratio of 4.5/1.0 minimum.

HYL designed its most competitive solution in 1980, featuring high hydrogen reducing gas (close to 70%), high productivity, minimum energy and water consumption, electricity co-generation, use of 100% lump ore and production of premium quality DRI.

Pilot plant tests were carried out using pure hydrogen for DRI production, but it was found that hydrogen was so light that the pressure drop through the reactor was so small that the gas stream channeled and was not properly distributed and irrigated through the solid bed. Besides, because of the highly endothermic reactions DRI metallization could be adversely affected. Due to the above, it was determined that the highest feasible hydrogen content would be 85%.

On the other hand, steel is an alloy made of iron and carbon, so the use of carbon sources cannot be fully eliminated. Natural gas is the cleanest fossil fuel available so the use of a natural gas/steam reformer leads to the most environmentally friendly technology, maximizing hydrogen production, taking advantage of high pressure steam for electricity generation, as well as controlling the DRI carbon content for steel quality optimization.