PRIMETALS TECHNOLOGIES

Press

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HYFOR pilot plant under operation – the next step for carbon free, hydrogen-based direct reduction is done

- **Successful first tests of HYFOR performed at the pilot plant at the voestalpine site in Donawitz**
- **Use of 100% Hydrogen as reduction agent lowers CO_2 footprint close to zero**
- **Low Opex and Capex cost as no agglomeration step is required**
- **Only process worldwide using iron ore concentrate fines with 100% particle sizes smaller than 0.15 mm**
- **Modular plant design to match individual customer requirements**

In April, the Hydrogen-based fine-ore reduction (HYFOR) pilot plant developed by Primetals Technologies was commissioned at the voestalpine site in Donawitz, Austria. First tests were successful. Test with various iron ore concentrates will continue to collect a sound data basis. Use of 100% Hydrogen as reduction agent reduces the CO_2 footprint close to zero. The HYFOR pilot plant employs the world´s first direct reduction process for iron ore fines concentrates from ore beneficiation, not requiring any agglomeration like sintering or pelletizing. This reduces CAPEX and OPEX costs. HYFOR represents the only process worldwide capable of processing iron ore concentrate fines with 100% particle sizes smaller than 0.15 mm, and a wide variety of ores, e.g. hematite and magnetite, supplied by different customers of Primetals Technologies worldwide. The direct reduction plant will come in a modular design, allowing for a tailor-made scaling for customers for all sizes of steel plants.

First tests have been successfully executed in April and May 2021 The scale of one test run is in the range of processing of 800 kg iron ore. The HYFOR pilot plant shall be operated for at least 2 years in multiple campaigns to test various ore types and to evaluate the optimal process parameters for the next scale up step. Smooth operation assumed, a hot briquetting unit will be added to verify the hot briquetting step as well as the HBI quality to be expected from the HYFOR technology.

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Primetals Technologies has developed the world´s first direct reduction process for iron ore concentrates not requiring any agglomeration like sintering or pelletizing. Primetals Technologies can resort to the comprehensive experience from the earlier Finmet/FINORED and FINEX development and plant installations. The new technology can be applied to all ore types (hematite and magnetite) and particle sizes of up to 100% smaller than 0.15 mm. As primary reduction agent, the new process uses 100% Hydrogen from renewable energy or alternatively H_2-rich gases from other gas sources like natural gas pyrolysis or conventional steam reformers. This results in a low or even a zero CO_2 footprint. The direct reduction plant will come in a modular design, making it available for all sizes of steel plants. The product is hot DRI for direct hot transport and feed to the downstream melting like EAF or Hot Briquetted Iron (HBI) for being sold to the market.

The use of DRI/HBI is expected to continue to grow due to the need to the strong demand to decarbonize the steel sector and the growing number of electric arc furnaces in service worldwide. Currently, all available technologies require agglomeration, like pelletizing to produce DRI or HBI. An additional challenge steel producers face, is the reduced quality of iron ore, resulting in the need to beneficiate the iron ores. In order to progress to a CO_2-free steel production, a process using mainly H_2 is most desirable. The new HYFOR process developed by Primetals Technologies takes care of all the above considerations.

The HYFOR pilot plant consists of three parts: a preheating-oxidation unit, a gas treatment plant and the actual reduction unit. In the preheating-oxidation unit, fine ore concentrate is heated to approx. 900 °C and fed to the reduction unit. The reduction gas, 100% H_2, is supplied over the fence from a gas supplier. A dry dedusting system takes care of dust recycling to prevent emissions from the processes involved. The hot direct reduced iron (HDRI) leaves the reduction unit at a temperature of approx. 600 °C before its cooled down and discharged from the HYFOR pilot plant. The next step will be the addition of a Hot Briquetting Testing facility to produce Hot Briquetted Iron (HBI).

The aim of the HYFOR pilot plant is to verify this break-through process and to serve as a testing facility to provide the data basis for upscaling the plant size to an industrial-scale prototype plant as the next development step.

This project is funded by the Climate and Energy Fund and is carried out under the program "Energieforschung". For further information: www.klimafonds.gv.at, www.energieforschung.at

Photo of the HYFOR direct reduction pilot plant for iron ore fines developed by Primetals Technologies and located at the voestalpine site in Donawitz, Austria. The DR process is CO_2-free and H_2-based.

This press release and a press photo are available at www.primetals.com/press/

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Primetals Technologies, Limited, headquartered in London, United Kingdom, is a pioneer and world leader in the fields of engineering, plant building, and the provision of lifecycle services for the metals industry. The company offers a complete technology, product, and services portfolio that includes integrated electrics and automation, digitalization, and environmental solutions. This covers every step of the iron and steel production chain—from the raw materials to the finished product—and includes the latest rolling solutions for the nonferrous metals sector. Primetals Technologies is a joint venture of Mitsubishi Heavy Industries and partners, with around 7,000 employees worldwide. To learn more about Primetals Technologies, visit the company website www.primetals.com.

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