

TransZeroWaste Project: Hot Microwave Pelletising Technology in the Upgrading of Low-Quality Iron Ores and Mill Scale with Low Carbon Technologies

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Growing demand for high quality iron ores and scrap as well as abandonment of carbon intensive sintering in the future require novel technological approaches for upgrading of low-grade iron ores and recycling of mill scale. TransZeroWaste will apply hydrometallurgy for mill scale de-oiling and use this and other iron-rich scrap equivalent to upgrade low-grade iron ores. For that, TransZeroWaste will develop low carbon technologies such as cold pelletising and briquetting, hot microwave pelletising, and magnet-supported hydrometallurgy. TransZeroWaste will serve as a vehicle for the transition of the European steel industry to the carbon free zero waste future.

Hot pelletisation with microwaves will be used for upgrading low-quality iron ores to increase the iron grade as new breakthrough technology for a low CO₂ material treatment. The method to upgrade iron ore of minor quality, as well for separation of interfering components as oil or zinc, is based on the new concept of treating granular feedstock for material transformation using microwave energy in cellular kilns. The system is conceived as modular units - material feeding + product microwave (MW) processing. Thus, the system is compatible and easy to integrate, which reduces the investment needed. The concept is indeed a paradigm change: it enables new small low-cost solutions to be integrated in large existing industrial processes for fast-track industrial implementation. The new system will be a clear opportunity to improve the current industrial heating processes by raising the energy efficiency, in particular for low production (downscaled) operations, since most of them are currently inefficient, expensive, and unfeasible for cost-effective production.

Microwave heating offers an efficient alternative to high-energy consumption conventional heating techniques, still common to a wide range of industrial manufacturing processes [1]. Hot pelletisation with microwaves of residuals was studied in the previous project DESTINY [2]. The scalability allows the use of all the power from the best available technology from microwave generators for easier implementation. Studies about materials and microwaves interaction at high temperatures have shown the advantages of modulating internal wavelength. This approach will allow raw materials to be efficiently heated. A new concept of electromagnetic field distribution is the base of a new concept of microwave applicator enabling the processing at higher volume adapting the feedstock speed with power and microwave tuning on real time and therefore better scalability for industrial application.

Total impact of TransZeroWaste will include upgrading of 27 million t/a materials with low carbon technologies and avoiding of corresponding sinter plant carbon footprint of 4,3 – 9,9 MtCO₂/a. TransZeroWaste will serve as a vehicle for the transition of the European steel industry to the carbon free zero waste future.

References

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