AISTech 2022 — Proceedings of the Iron & Steel Technology Conference
16–18 May 2022, Pittsburgh, Pa., USA
DOI 10.33313/386/204

Enhanced Blast Furnace Through Syngas Injection From Natural Gas: A New Era For Blast Furnace Technology Enabling Reduced GHG Emissions, OPEX Improvements, Efficient Carbon Capture and Lean Gas Valorization

Marco Perato[1], Fabio Cravino[1], Peter Kinzel[2], Cristiano Castagnola[1]

[1]Paul Wurth Italia S.p.a. (SMS Group)
Via Balleydier 7, 16149, Genova, Italy
Phone: +39 010 64091

[2]Paul Wurth S.A. (SMS Group)
Rue d'Alsace 32, 1122 Luxembourg
Phone: +352 4970 0
Email: Marco.Perato@sms-group.com – Fabio.Cravino@sms-group.com Peter.Kinzel@sms-group.com - Cristiano.Castagnola@sms.group.com

Keywords: blast furnace; Enhanced blast furnace; syngas; shaft injection; Co2 Reduction; Green Steel; Carbon Capture

INTRODUCTION

Green House Gases (GHG) emission reduction in the steel making requires an evolution of present technologies.

Enhanced Blast Furnace Technology, through injection of syngas from natural gas in the blast furnace at tuyeres and/or at shaft level, allows consistent reduction of typical reducing agents such as coke and coal.

The resulting increase of Natural gas share, beyond the typical operation limits of present Blast Furnaces, would therefore allow lowering the CO_2 footprint, enabling to further extend the use of blast furnaces during the transition period towards steelmaking with zero GHG emissions.

Additional benefits of Enhanced Blast Furnace Technology are Opex reduction, wherever plants are located in countries with competitive natural gas prices such as North America, as well as synergies with pre-combustion CO_2 capture. Post treatments of lean gas (blast furnace gas) in pre-combustion carbon capture systems shows an increased efficiency of capture itself thanks to the higher LHV of the BF gas generated in an Enhanced Blast Furnace. Such advantages further increase the reduction of achievable carbon footprint of the plant.

This paper will describe interaction and advantages of both technologies, focusing on the key economic aspects (opex impacts) as well as environmental benefits in terms of CO_2 emission reduction.

ENHANCED BLAST FURNACE TECHNOLOGY

Introduction

The world crude steel production is largely based on the blast furnace (BF) - basic oxygen furnace (BOF) route [1]. Accordingly, technological improvements focusing on BF-BOF route to abate steel CO_2 footprint needs to play an important role to achieve the reduction targets of Green House Gases (GHG) set by major economies.

To reduce the CO_2 emission of the BF process, reduction of specific total carbon input shall be aimed (Carbon Capture of produced gasses can be another alternative and is analyzed separately in the following chapters).

For this purpose, Enhanced Blue Blast Furnace Technology, see Figure 1, consists among other improvements, in the injection of syngas (a gas composed mainly by CO and H_2) at a second level of the furnace in the lower shaft, above the Blast Furnace cohesive zone is here introduced and analysed.

