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A critical review on Post Combustion in converter steelmaking

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In the basic oxygen furnace (BOF), CO is generated as a result of the decarburization reactions that occur during the refining process. This CO formed can react with the oxygen from the jet, leading to carbon dioxide (CO_2) formation through post-combustion reaction in the free jet region above the molten metal. The post-combustion reaction generates about 2.5 times the energy amount that the C combustion reaction produces. If effectively transferred back to the melt, the CO_2 formation in the BOF consequently enhances the heat available for the process. In addition, a reliable prediction of post-combustion inside the furnace can be useful for understanding the oxygen partitioning between decarburisation and FeO formation. This understanding can be related to early blow slag formation which is critical for the BOF process control.
Past studies and industrial data show that the CO_2/CO + CO_2 ratio (post-combustion ratio) during the BOF refining period is transient in nature. The variation in PCR observed during the early stage of the blow is not yet fully understood. Dynamic process variables, including lance position, scrap characteristics, oxygen flow rate, and the height of slag foaming, significantly influence the post-combustion ratio. However, the rapid changes of these variables during the initial blowing stage make it challenging to establish a clear relationship between the post-combustion ratio and these process parameters.
This study conducts a critical literature review to determine and explore the impact of these key variables on the CO_2/CO + CO_2 ratio during converter operation. The findings from the literature review are validated with plant data of a 330t converter operated at Tata Steel, Netherlands. By analyzing the critical factors influencing the post-combustion, this study provides insights into optimizing the BOF process.

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Netherlands

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Primary authors: BOTINHA LOPES CANCADO, Roberta (Tata Steel Netherlands); ROUT, Bapin (Tata Steel Netherlands)

Presenters: BOTINHA LOPES CANCADO, Roberta (Tata Steel Netherlands); ROUT, Bapin (Tata Steel Netherlands)

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