

Upgrading and Recycling of Blast Furnace Sludge

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Conclusion

- Fine-grained, low zinc-containing blast furnace (BF) sludge could be upgraded – removing zinc.
- The low-zinc fraction of the upgraded sludge could be recycled to the BF via cement-bonded briquettes.

Introduction

Recycling of both BF dust and sludge to the BF is desirable as both have a chemistry dominated by iron and carbon.

Depending on the operation of the BF, the dominating output of zinc can be via the top gas. In order to recycle both the BF dust and sludge, a bleed of Zn need to be introduced to avoid accumulation of Zn in the furnace. Figure 1.

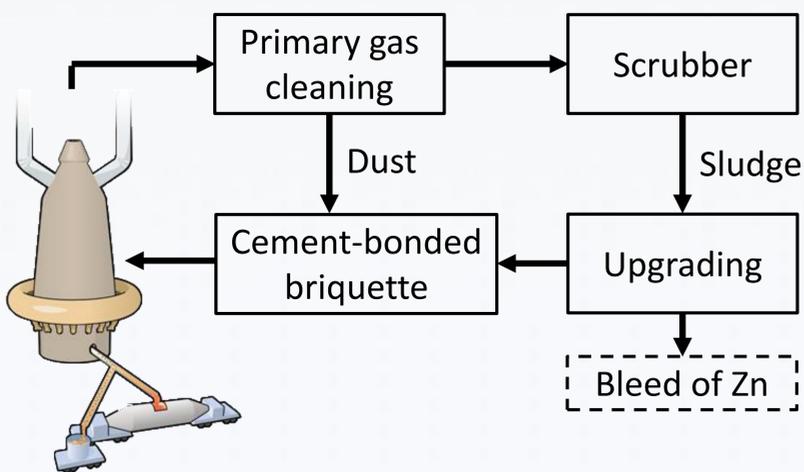


Figure 1: Bleed of Zn. [BF illustration from SSAB Europe]

Aim

The aim of the study was to investigate if a low-zinc, fine-grained BF sludge could be upgraded – by removing zinc – and recycled in the BF using cement-bonded briquettes.

Upgrading and Briquetting

A low-zinc containing, fine-grained BF sludge was upgraded using different methods including hydrocycloning, sulfuric acid leaching and the tornado process. The efficiency of the separation of zinc from iron and carbon is presented in the table below. The low-zinc fraction from the tornado process was included in a cement-bonded briquette for recycling in the BF.

Distribution of total amount to low-zinc fraction (%)

Method	Zn	Fe	C	Solids
Hydrocyclone	26	66	37	59
Leaching, pH 1	5	91	100	86
Leaching, pH 3	20	96	100	93
Tornado	19	37	39	31

Laboratory Scale BF Experiment

A laboratory scale BF experiment developed by LKAB was utilized to study three different briquette recipes:

- One reference recipe representing the industrial briquette currently recycled.
- One with 10 wt% added upgraded BF sludge.
- One with 20 wt% added upgraded BF sludge.

The addition of upgraded BF sludge did not have any negative effect on the reducibility of the briquette. Furthermore, the added BF sludge improved the integrity of the briquettes after reduction.

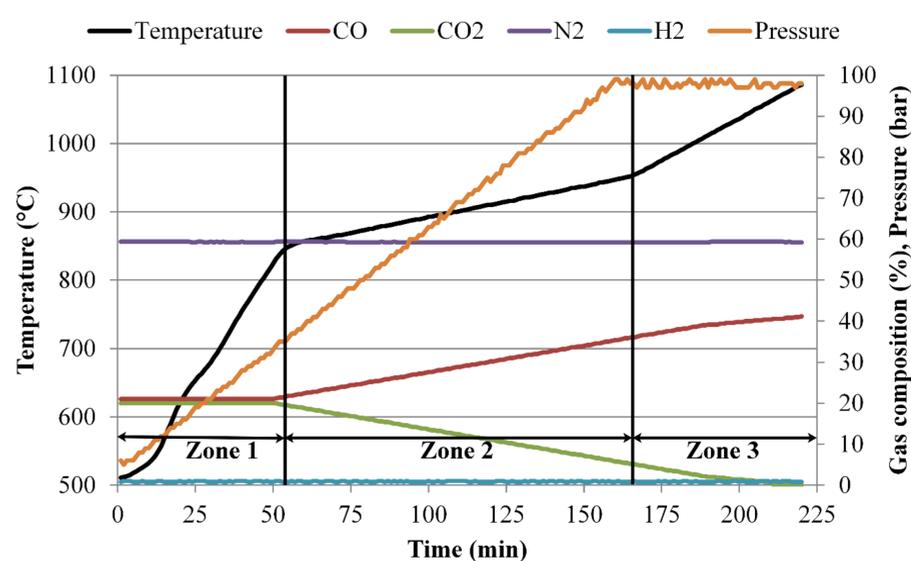


Figure 2: Laboratory scale BF experiment.

LKAB Experimental BF

The three briquette recipes were charged as basket samples in the LKAB EBF during campaign K32 in 2016. The addition of upgraded BF sludge did not affect the reducibility or the strength of the briquettes negatively.

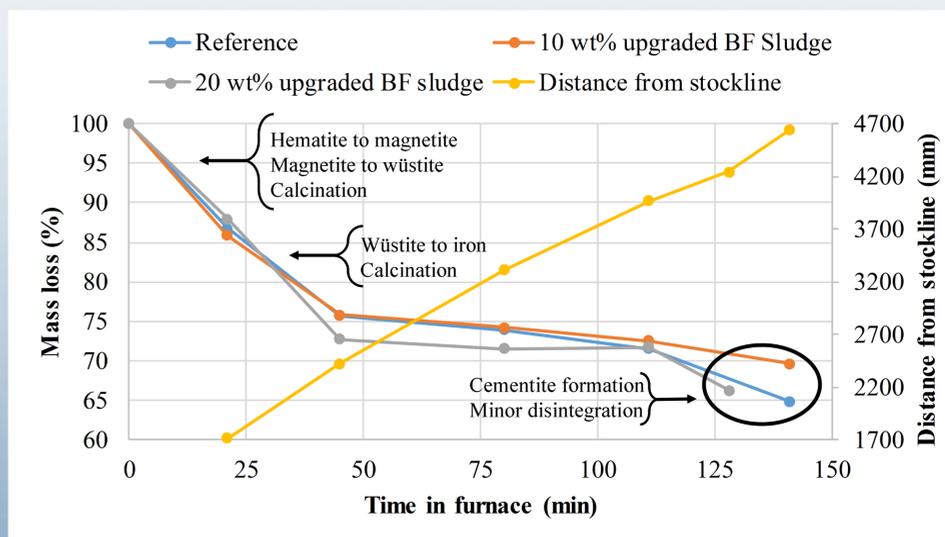


Figure 3: Mass loss and reactions in the LKAB EBF.