Development of Highly Efficient Fluidized Lime for Hot Metal Desulfurization Based on Thermodynamic Calculations and Industrial Validation

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ABSTRACT
Desulfurization is a critical step before converting hot metal to steel. Increasing sulfur inputs while decreasing sulfur targets is difficult and more challenging with approaches like introducing carbon-neutral biomass into blast furnaces. Lhoist investigated improving hot metal desulfurization with innovative blends (Flucal®). Based on carry-over slag analyses and enhanced fluidized lime, a theoretical final slag was calculated regarding sulfur capacity and viscosity. Special focus lied on intensified agitation and reduction of fluorine content. Three new recipes were identified and industrially verified. The sulfur removal efficiency was improved 12.7%, treatment time was decreased 10% and splashing was minimized.

Keywords: Hot metal desulfurization, fluidized lime, Flucal®

INTRODUCTION
The quality of the raw materials used to produce hot metal has declined over the years due to diminishing quality of iron ore, metallurgical coke, and coal. This means that the steel industry needs to cope with more impurities, but their final products should contain less impurities. In iron- and steelmaking, sulfur is considered as an unwanted impurity, because sulfur increases the brittleness of steel and decreases the weldability and corrosion resistance, therefore it needs to be removed (although there are certain steel grades that require sulfur) [1]. Especially when considering the green steel transition [2,3], then the utilization of biomass and other recycled carbon might increase which can lead to a further increase of sulfur input into the BF [4,5].

Hot metal desulfurization (HMD) is an important step to reduce the sulfur level of the liquid metal after the blast furnace (BF) and before the converter process. Although it is possible to desulphurize steel after the converter process, it is preferred from an economical point of view to remove the sulfur from the hot metal before charging it to the converter. During the HMD process benefiting from the low oxygen activity, dissolved sulfur reacts with reagents, typically magnesium and/or lime and/or calcium carbide, to form sulfides that end up in the slag phase. Magnesium achieves fast desulfurization while lime and/or calcium carbide allow for low final sulfur concentrations. When the slag is removed after reagent injection, the hot metal is desulfurized [6,7].

In this study, 4 different quicklime mixtures (Flucal® Mix) were employed in industrial trials. Different Flucal® recipes were tested to evaluate the hot metal desulfurization performance regarding treatment time, Mg and Flucal consumption and Number heats redesulfurization.