Industrial application of aluminum slag in steelmaking process

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INTRODUCTION

In the production of aluminum, a lot of aluminum slags were generated. Many trials have been done all over the world to recycle aluminum slag in most economic ways. Waste aluminum slag was used as raw materials to make calcium aluminate cement “refractory cement” or to synthesize mullite materials, which belongs to the comprehensive utilization of wastes with a great economic and environmental significance [1,2]. Aluminum slag contains a lot of Al_2O_3 and elemental aluminium inside which could be used to improve the properties of the refining slag in steelmaking process. The elemental aluminium is used as deoxidizer, while Al_2O_3 can improve the fluidity of the refining slag. A large amount of steel was produced in China and a lot of refining slags were needed for steelmaking, especially for the production of high quality steel. So, large amounts of aluminum slags could be utilized with a great environmental significance. Aluminum slag can be added into the refining slag with CaO in steelmaking process. Then the slag will have both good fluidity and good deoxidation ability which have great benefits for the production of clean steel [4,5].

METHODS AND MATERIALS

The element composition for the slag was analyzed by x-ray fluorescence fpectrometry (RIX, 3000X, Japan) and was represented by the CaO- Al_2O_3 -SiO_2 ternary phase diagram according to the variations of slag types at different times. The steelmaking process of production for trials is Pretreatment of hot metal → LD → LF refining → Calcium treatment → CC (continuous casting). In this steelmaking process, deoxidation was done by SiMn alloy after the LD process and deep desulfurization (≤50ppm) and the alloying composition were adjusted in LF refining. The protection of the casting was enhanced to prevent the secondary oxidation. The process of calcium treatment was also used to control the morphology of inclusions. The aluminum slag was pressed into ball shape with the size of 40mm in diameter and added into ladle at the beginning of LF refining process with CaO.

RESULTS

BW, EW, BS and ES is at the beginning of LF refining for weak deoxidation (SiMn alloy as the deoxidizer), at the end of LF refining for weak deoxidation, at the beginning of LF refining for strong deoxidation and at the end of LF refining for strong deoxidation (Al alloy as the deoxidizer), respectively.

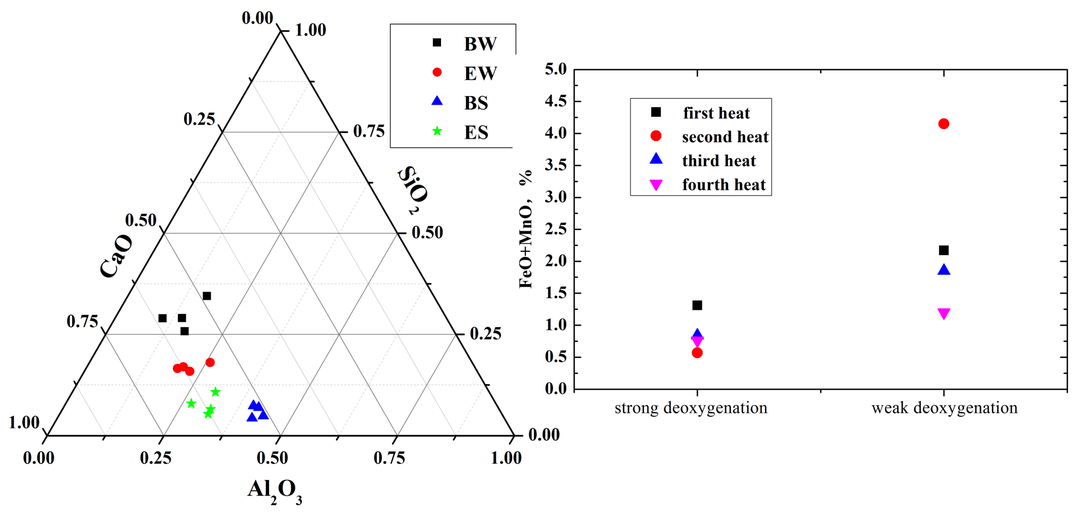

Figure 1&2 : (1. The composition of slag at different times with different deoxidation agents; 2. (FeO+MnO)% in slag for different deoxidation agents)

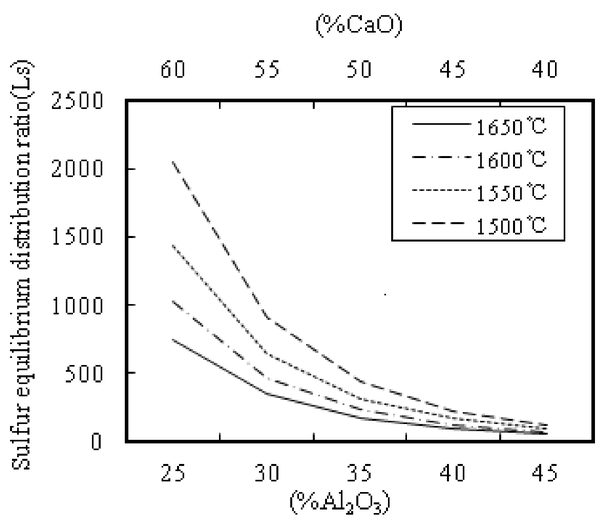

Figure 3 : Sulfur equilibrium distribution ratio of different temperatures and different $(Al_2O_3)/(CaO)$

CONCLUSIONS

✓NFor weak deoxidation process, oxidizing ability is significantly reduced which have great benefits for the production of clean steel by adding aluminium slag.

✓Adding aluminium slag can increase Al_2O_3 content to 20%-30% which has a large Ls which can reduce the subsequent addition of Al content and the subsequent desulfurization pressure. Sed ornare, nibh eget elementum tristique, nisl libero porta sapien, ac posuere neque ante sed nisl.

✓From the average result of trials, weak deoxidized steel can shorten the time of slagging process of 2-3 min by adding aluminium slag.

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