PAPER ID:43

AN INNOVATIVE SLAG ENGINEERING APPROACH FOR IMPROVING DE- SULPHURISATION EFFICIENCY IN SILICON KILLED STEELS

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ABSTRACT

Quality requirement of customers are becoming more stringent w.r.t low level of sulphur in final product for better mechanical property of steel. High sulphur in steel leads to poor internal quality in the form of cracks and sometimes causes break out during continuous casting of steel. In past, various studies have been carried out to investigate the desulphurisation process in steelmaking. But most of the work has been focused on desulphurisation of steel with high-basicity slag and in steels killed by aluminium. However, many steel grades which are silicon killed are having low slag basicity. Very few studies are available on desulphurisation of steels deoxidised with Si-Mn and having a low basicity slag comprising of system $CaO–SiO_2–MgO–Al_2O_3$.

Durgapur Steel Plant, a unit of Steel Authority of India Limited was facing problems of high sulphur in steels which were subjected to silicon killing. Final sulphur in Si-killed steels at Durgapur Steel Plant (DSP) was 0.028% average. High sulphur in steel was one of the bottlenecks in improving the quality of steel as well as one of the reasons of low throughput of continuous casters at DSP. De-Sulphurisation of silicon killed steel is a difficult task owing to inherent nature of steel melt as well as ladle top slag. In case of Si killed steel, the ladle top slag which is basically siliceous in nature has a lower sulphide capacity, lower sulphur partition ratio, and adverse physio-chemical characteristics. Also, the oxygen potential of both the bath as well as slag is higher as compared to normal Al killed steels.

The present work was carried out in improving the desulphurisation level in steels subjected to silicon killing. Slag engineering was done in a novel way to make conditions more conducive for desulphurisation of steels. Deoxidation and flux addition practice was modified in an innovative way to decrease the SiO_2 generation and also to reduce the oxygen potential of slag. Plant scale trials were conducted with modified deoxidation and flux addition practice. 60% De-S was achieved in heats i.e sulphur reduction from 0.039% (S in hot metal) to 0.015% (S in final product). Morphology and composition of inclusions were also investigated by SEM-EDS to compare the effects in modified practice. A process technology was established for production of low sulphur steels at DSP, SAIL.

Keywords: Steel Desulphurisation, Slag Engineering, Sulphide capacity, deoxidation, inclusions, clean steel