

**ABSTRACT**

Key words: Dephosphorisation, low carbon steel, basicity ratio, optical basicity, activation energy, high carbon cast iron, desulphurisation, electrochemical technique.

The demand for low phosphorous steels have increased dramatically over the recent years since reduction of phosphorous in steel improves its ductility and notch bar toughness. It is known that dephosphorisation is generally better achieved under an oxidizing atmosphere. There is also a great demand to reduce sulphur which causes hot shortness and makes steel prone to cracking during various metal forming operations. For better desulphurisation, one generally requires reducing conditions which is best provided by the hot metal. The reaction for sulphur transfer from the metal phase to the slag phase is also known to be electrochemical in nature.

This thesis presents experimental data on dephosphorisation of a low carbon steel using different fluxes. It also presents some data on desulphurisation of high sulphur cast iron using an electrochemical technique. In the present investigation, an attempt has been made to remove phosphorous using oxidizing slags of different types. Fluxes have been added as powders directly as well as through injection using a powder dispenser fabricated in the laboratory. Data on phosphorous removal have been correlated with different slag basicity indices. In addition some kinetic studies have also been carried out to suggest the mechanism of dephosphorisation through calculation of activation energy.

A novel experimental technique has been developed to enhance the rate of removal of sulphur using electrochemical means. The technique, though found to be quite effective in the case of sulphur removal from high sulphur cast iron, was not found to be as successful in the case of low sulphur cast iron.

It is confirmed that the best results are obtained by injection of fluxes containing  $\text{Na}_2\text{O}$  and  $\text{CaF}_2$  and the desulphurisation results are better interpreted in terms of optical basicity. The electrochemical technique is an effective method of sulphur removal from high sulphur cast iron. However, further studies are required to explore its application in the industry.