**ABSTRACT**

In this study, the factors affecting sulphur distribution ($L_s$), phosphorus distribution ($L_p$), sulphide capacity ($C_{S^{-2}}$) and phosphide capacity ($C_{P^{-3}}$) of ferrochromium smelting slags were investigated under reducing conditions at 1600 $^oC$. Also, sulphur distribution ($L_s$) and sulphide capacity ($C_{S^{-2}}$) of ferromanganese smelting slags were studied under reducing conditions at 1500 $^oC$.

The results showed that the logarithms of sulphide capacities varied between -7.67 to -9.28 and the logarithms of phosphide capacities were between -15.20 and -12.69 for ferrochromium smelting slags. On the other hand the logarithms of sulphide capacities of ferromanganese slags were found to be change between -7.63 and -8.11.

The experimental results indicated that CaO, $SiO_2$, MgO and basicity ratio of the slags were the main factors affecting phosphide and sulphide capacities of ferroalloy smelting slags.

According to the results, the transfer of sulphur and phosphorus from metal to slag phase increases with increase in the basicity ratio, calcium oxide and magnesium oxide content of ferroalloys smelting slags. Also, it was found that sulphide and phosphide capacities of ferroalloys smelting slags tend to decrease with increasing concentration of silica in the slag phase.

Structural models based on binding energy of $O^{-2}$ ions in the slag systems were developed by using the linear relations among the logarithm of sulphide and phosphide capacities of slags. In addition to these models, easy to use quadratic multivariable regression model equations were developed in order to express sulphide and phosphide capacities of the ferroalloy smelting slags and sulphur and phosphorus partition ratios between slag and metal phases. These simple models which are combination of regression and thermodynamic approaches can be used in industrial ferrochromium and ferromanganese smelting operations. The usage of these models can help ferroalloy smelting process engineers to predict sulphide and phosphide capacities of the relevant slag systems.