EAF Stainless Steel Refining - Part I: Observational Study on Chromium Recovery in an Eccentric Bottom Tapping Furnace and a Spout Tapping Furnace

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An observational study of the electric arc furnace (EAF) process for austenitic stainless steel was performed. A comparison was made between two distinct EAF types: (1) an eccentric bottom tapping furnace (EBTF) and (2) a spout tapping furnace (STF). In order to study the slag evolution during the EAF process, per heat several slag samples were collected at consecutive process stages. They were subjected to electron probe microanalysis using energy dispersive spectroscopy (EPMA-EDS). Compositional and mineralogical data from 36 heats corroborate that both thermodynamic and kinetic conditions exert a strong influence on the final chromium oxide content of the slag. In the STF, chromium oxide reduction predominantly occurs during tapping, owing to the intimate mixing of steel and slag. A multivariate linear regression analysis reveals that the main parameters determining the overall chromium recovery are the slag basicity and the content of dissolved silicon of the steel. These parameters explain 70% of the observed variance in final chromium oxide levels and can be used as control parameters to improve the chromium recovery. For the EBTF, lower chromium recoveries are recorded due to the absence of sufficient mixing during tapping.

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