

Abstract

The competitiveness of any industry, to a large extent depends, on its optimization strategy vis-à-vis energy and resources. This is more perceptible in the case of new process/product industry. Since last four decades, several commercial plants are installed for the production of sponge iron in different parts of the World. However, direct reduction process based on noncoking coal for sponge iron making is passing through a developmental stage. The energy audit of such plants indicates the possibility of reduction of operational energy cost and also capital investment.

The rotary kiln being the main part of noncoking coal based sponge iron making accounts for about 50-55% of the total energy requirements. Therefore, some areas of rotary kiln/reactor such as air to fuel ratio, fuel consumption, air distribution system, optimization of flue gas retention in the kiln, coal injection system, sealing arrangement of kiln and rotary cooler and the use of atomized water cooling system in post combustion chamber are studied. Attempt is being made to estimate the scope of energy savings in these areas of rotary kiln unit of sponge iron plants.

India is fast emerging as an important global player in the casting sector of metallurgical industry. There is a growing awareness regarding pollution control levels in India in recent times and this is perceived as a threat to the existence of small scale foundry units scattered in various parts of the country. Attempt has been made to carry out research and development work on development of an eco-friendly cokeless cupola and suitable gas cleaning plants for conventional coke based cupolas of various modules.

This thesis addresses the following problems associated with sponge iron plants and foundry units and makes an attempt to contribute to the solution of the same.

- Optimization of energy consumption in noncoking coal based sponge iron plants using available stabilized plant operation data and through mathematical modeling.
- Pollution abatement techniques for foundry sector to limit the suspended particulate material and SO_x within norms. Illustrative case studies of installed pollution control system are highlighted in this work.
- Techno-economic evaluation of suggested changes in technologies for pollution abatement in foundry sector.

The whole research work is organized into five Chapters. In each Chapter wherever necessary, illustrative case studies have been presented and numerical examples are also given to validate the mathematical modeling.