COKE AND COAL IN THE CHANGING TECHNOLOGY OF THE BLAST FURNACE

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Summary

The steadily rising cost of hydrocarbons in relation to coal has resulted in a rapid shift towards coke- and coal-fuelled blast furnace operations. This trend has been associated with the most recent developments in blast furnace technology, i.e. the revolving chute charging system and the use of blast temperatures over 1200°C. The role of coke characteristics is discussed in the context of the need for continuous refinement of blast furnace technology. The importance of the following points is stressed: use of the size distribution of the coke in order to form charge layers varying in permeability along the radius of the blast furnace and to influence the shape of the melting zone; coke reactivity and coke size degradation as it descends down the blast furnace; knowledge of the links between the parent coals, the coking conditions and the coke structure. The characteristics of formed coke can be controlled during the production process and can, therefore, be adapted to the utilization process. As regards the replacement of fuel oil injection, the problems connected with rapid coal combustion in the tuyeres are examined. An examination is also made of the possibilities offered by the new coal-oil-mixtures (COM) and coal-water-mixtures (CWM), which are still a field for research. Coal-water-mixtures would also make it possible greatly to simplify injection equipment for blast furnaces.
The fact that hydrocarbons (fuel oil and natural gas) are now more costly than coal, combined with predictions that this price differential will be maintained in the future in spite of increased coal demand for energy production, means that hydrocarbons are rapidly being eliminated from blast furnace operations. Fuel oil injection in blast furnaces used to have a number of economic advantages, and it facilitated certain significant improvements in the running of blast furnaces. In general, one kg of fuel oil was able to replace 1.3 kg of coke. Furthermore, fuel oil injection made it possible:

1. to use high blast temperatures, to control the combustion temperature (by utilizing the heat consumption associated with oil cracking), and to reduce the overall heat cost of the process;
2. to increase the productivity of the blast furnace by means of an overall reduction in the specific fuel consumption and thus in the blast and in the gas which correspondingly passes through the blast furnace. It is clear that the following factors have made an important contribution here:

   a) the improvement in techniques for preparing the ferruginous charge (sinter and pellets) and the coke,
   b) the increase in the operating pressure of blast furnaces, and,
   c) improvements in the equipment - both in general, and in the systems for charging, controlling and regulating blast furnaces in particular.

It is within this framework of problems and changes that I shall examine the role of coke and coal in the return to operating blast furnaces entirely on coal.

COKE IN THE BLAST FURNACE - CHARGING

The significant advantage of the most recent blast furnace charging systems (which have moveable plates and revolving chutes) is that, by offering a wide range of methods of changing the distribution of the charging materials, they