Recent Progress of Cokemaking Technology in Japan

Author

S. Nomura
general manager, head of division,
Ironmaking Research Lab,
Process Research Laboratories,
Nippon Steel & Sumitomo Metal Corp., Chiba, Japan
nomura.e9c.seiji@jp.nssmc.com

The cokemaking technology division in a mill in Japan has experienced problems such as price increase and quality deterioration of metallurgical coal, coke oven aging and social demand for environmental friendliness. The Japanese cokemaking industry has struggled to cope with these challenges by developing various new technologies. This paper provides a summary of the recent progress of cokemaking technology such as coal pre-treatment technology for utilizing low-grade, semi-soft coking coal, diagnosis and repair apparatus for coke oven chamber wall, and a method to turn waste plastics into chemical raw materials using coke ovens.

Recently the global steel industry has faced drastic changes in the demand-and-supply balance of steel products, leaving raw material prices extremely volatile. Under these surroundings, the Japanese cokemaking industry faces three major problems. The first is availability of hard coking coal. Japan depends on imports for coking coal for steel production. Due to the strong demand for steel caused by the expansion of the global economy, coal prices have increased drastically. In accordance with the price increase, the quality of coking coal is deteriorating. Japan needs to develop a technology to produce coke from low-grade coal. The second is the problem of aging coke ovens. The average age of old coke oven batteries in Japan is now 42 years and it is very important to develop coke oven life extension technology. The third is the demand for CO_2 reduction.

This report provides a summary of the recent progress of cokemaking technology in Japan, such as: (1) coal pre-treatment technology for utilizing low-grade semi-soft coking coal (coal moisture control (CMC), dry-cleaned and agglomerated pre-compaction system (DAPS) and Super Coke Oven for Productivity and Environmental Enhancement Toward the 21st Century (SCOPE21)), (2) coke oven life extension technology (diagnosis and repair apparatus for coke oven chamber wall; Doctor of Coke Ovens (DOC)) and (3) environmental technology such as a method to turn waste plastics into chemical raw materials using coke ovens and ferro-coke process. Finally, introduced is a specific fundamental research project sponsored by the Iron and Steel Institute of Japan (ISIJ) to tackle problems in cokemaking technology.

Coal Pre-Treatment Technology for Utilizing Low-Grade, Semi-Soft Coking Coal

CMC and DAPS — Nippon Steel & Sumitomo Metal Corp. (NSSMC) developed dry coal charging processes for coke production. In the coke oven, heat supplied by conduction is used for evaporating water, which is not energy efficient. In Japan, where energy cost is expensive, coal pre-treatment technology has been studied and developed to improve energy efficiency. The basic concept is to dry coal before it is charged into the coke oven chamber. Two typical examples are CMC and the DAPS. As shown in Fig. 1,[1] in CMC coal is dried in a steam tube dryer and the moisture decreases from 10% to 5–6%. The lower limit