

*3 FUKUMOTO Yasuhiro*4 TERADA Kaneo*5

Abstract:

k

† Originally published in *LHG IKJQ* No. 22 (Nov. 2008), p. 67–72



*1 Senior Researcher Manager,
Environmental Process Res. Dept.,
Steel Res. Lab.,
JFE Steel



*3 Staff Deputy Manager,
Ironmaking Dept.,
East Japan Work (Keihin),
JFE Steel



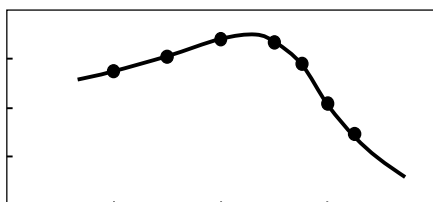
*4 Staff Deputy Manager,
Ironmaking Dept.,
East Japan Work (Fukuyama),
JFE Steel

*2 Senior Researcher Deputy General Manager,
Ironmaking Res. Dept.,
Steel Res. Lab.,
JFE Steel

*5 Staff Manager,
Recycle Project Sec.,
Recycle Promotion Dept.,
JFE Steel

and Packaging (commonly known as the Container and Packaging Recycling Law) was fully enforced in 2000, covering containers and packaging in municipal solid waste. The effects of enforcement of this law have become apparent, as can be seen in the increase in the effective utilization rate of waste plastics from 46% in 1999 to 72% by 2006²⁾.

Japanese industry also takes the problem of global



(tuyere nose). As shown in the same figure, methane has the highest combustion velocity, followed by pulverized coal and waste plastics in that order.

Therefore, first, the effect of mixing with pulverized coal was studied. Using the above-mentioned hot model experiment apparatus, tests were conducted with different methods of mixing waste plastics and pulverized coal. The results are shown in . Case 1 is the case of separate injection of waste plastics and pulverized coal using lances. Case 2 is the result of injection after mixing in the piping. In comparison with Case 1, an improvement of approximately 10% in the combustion and gasification efficiency was confirmed with Case 2.

This is estimated to be the result of acceleration of the combustion and gasification velocity of the waste plastics by the pulverized coal, which has a higher combustion velocity. shows the change in the velocities of plastic and pulverized coal particles injected in a 120 m/s gas stream. Although both types of particles are accelerated by the gas stream, the increase in the velocity of the plastic particles is delayed in comparison with the pulverized coal because the plastic particles are larger. This suggests residence time in the raceway in the furnace bottom. Because the residence time of the waste plastics is longer than that of the pulverized coal, this point shows that mixing with pulverized coal is advantageous for combustion. On the other hand, adhesion of pulverized coal to the surface of the waste plastics particles after mixing in the piping was confirmed, as illustrated in Fig. 3. This suggests that the combustion heat of the pulverized coal is supplied directly to the plastics, and thus accelerates combustion and gasification of the plastics. Because this adhesion also increases

because slag-forming of the ash component in waste
plastics is difficult due to the high melting p u `

M

?

blast pressure was observed. Samples of the shell were taken after the tests were completed, and X-ray diffraction measurements were performed. As a result, with the conventional agglomerated plastics, the shell consisted of Mullite ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$), but with CaCO_3 addition, the shell consisted of Anorthite ($\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$), which is a low melting point slag. Thus, assimilation of Ca was observed. Based on the results described above, it can be inferred that the CaCO_3 which was added to the plastic promoted slag forming/reduction of the melting point, and thereby alleviated pressure drop in the furnace.

This technology has been adopted at No. 3 blast furnace at JFE Steel's West Japan Works (Fukuyama District) and tet

with pulverized coal. Accordingly, the harmonic mean diameter of plastics for obtaining the same combustibility as the pulverized coal which is normally used can be estimated at approximately 0.2–0.4 mm from Fig. 8.

Based on the results of the fundamental study of combustibility and other behavior, a waste plastics pulverization process (Advanced Plastics Recycling Process: APR) with the flow shown in Fig. 9 was constructed at JFE Steel's East Japan Works (Keihin District) in March 2007. These facilities comprise a melting/mixing process, dechlorination, and a gas treatment process.