(109) Pilot Plant Test Results for Lead Free Pellet Process (Development of Lead Free Pellet Process: First Report)

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1. Introduction

In order to find the technical possibility of the pellet production process utilizing lead containing ore, small scale pilot plant tests have been carried out. Main purpose of the process is elimination of lead that is tramp element for ironmaking. From the test results, basic operating conditions have been established.

2. Test Conditions

1) Blending of Raw Materials;
ore concentrate/coke/bentonite = 100/4.5/1.5
2) Pelletizer Size; 1.0m dia. x 0.23m depth
3) Drying; batchous drying in a chamber
4) Rotary kiln; 0.4m dia. x 4.0m length

3. Test Results and Discussions

1) Investigation of Raw Materials

Chemical compositions and mineral forms of the ore concentrate are shown in Table 1. It contains not only iron but also manganese and barium. Iron is mostly in the form of hydroxide (mainly hydrogeothite), and hematite and siderite were also detected by X-ray diffraction. Lead content is ca. 0.6% in the forms of plumbojarosite, cerussite and galena.

Particle size of ore concentrate is coarse, accordingly it has been grount to the proper size (below 63 micron m = ca. 80%) before pelletizing.

2) Pelletizing

It is necessary to keep the compression strength and the abrasion resistance high enough to avoid breakage of pellets during transportation and revolution in the kiln.

Fig.1 shows the influence of moisture content of green pellets to the compression strength of dried pellets. The results indicate that the moisture content should be controlled in the range between 10 and 11%.

Maximum productivity has been estimated with reference data of the industrial SDR Plant.

Table 1. Chemical Compositions and Mineral Form of Iron Ore Concentrate

Element						
Fe_{tot}	Pb	Mn	Ba	SiO_2	CaO	Ig.loss
Chemical Compositions (%)						
40.3	0.59	8.95	4.55	7.28	2.94	12.0
Mineral Phase						
FeOOH	$PbFe_6(SO_4)_4(OH)_{12}$					
Fe_2O_3	$PbCO_3$					
$FeCO_3$	PbS					

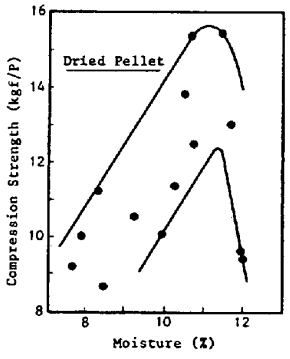

Fig. 1 Compression Strength vs. Moisture Content

3) Lead Elimination and Induration

The investigation results on lead elimination previously carried out in Bulgarian Iron and Steel Institute have been confirmed that lead vaporizes in the form of PbS. Accordingly, atmosphere should be kept reducing so that hematite formation is prevented. This behavior is evident in Fig. 2 of previous laboratory test results. Iron reduction up to magnetite is sufficient for the purpose of lead elimination.

The example data acquired in the pilot kiln test are plotted on Fig. 3. Iron oxide is quickly reduced near to wustite grade, and reoxidized in high temperatrue zone.

Lead is eliminated slightly later than iron oxide reduction. However, required lead elimination is easily achieved in the rotary kiln.

The higher temperature zone is utilized only for the hardening of the pellets, and compression strength of product pellets was ca. 110kgf/p.

4. Conclusions

Basic operating conditions of lead free pellet process have been established by the pilot plant test. These data are employed to the simulation calculation of an industrial kiln operation.

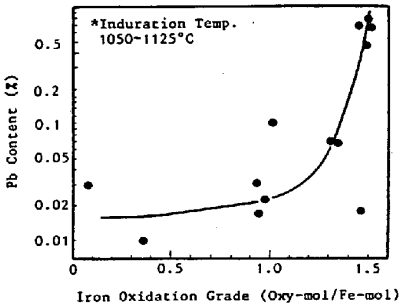

Fig. 2. Relation between Lead Content & Iron Reduction

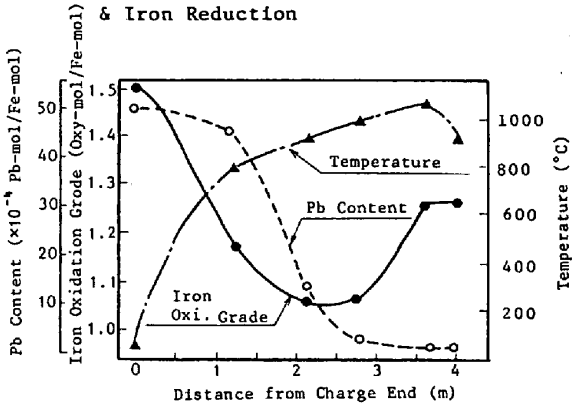

Fig. 3 Transition of Temperature, Lead Content & Iron Reduction