New Products & Technologies

Iron Oxide "KH-CP" for High-Quality Soft-Ferrite*

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1 Introduction

The Chemical Division of Kawasaki Steel Corporation produces several kinds of iron oxide (ferric oxide: Fe_2O_3) powder for soft ferrites from the waste pickling liquor generated from the steel pickling process. Kawasaki Steel has developed techniques to control the impurities and powder characteristics of iron oxide and is a major supplier of high-grade iron oxides for soft ferrites with a market share of more than 35% in Japan.

A recently increasing demand for soft ferrite products of smaller size and higher performance has emerged with the improvement in quality of electronic products. Iron oxides of better quality to produce soft ferrites are required in order to meet this demand. After developing improved techniques to remove impurities from iron oxide, Kawasaki Steel now produces newly developed KH-CP iron oxide for high-quality soft ferrite that meets the stricter requirement of the main ferrite manufacturers.

The quality and characteristics of KH-CP and its uses are introduced here.

2 Characteristics

KH-CP, which was originally developed by the Chemical Division and is manufactured in the Mizushima Works, belongs to the highest grade of all the iron oxide produces from Kawasaki Steel.

This iron oxide has the following features:

(1) The impurities in the iron oxide are made drastically lower than in other products.
(2) The particle size is fine and uniform, and the reactivity of KH-CP is high.
(3) Soft-ferrite cores manufactured from KH-CP have greatly improved magnetic properties such as a low power loss.
(4) KH-CP has a good cost-performance ratio because manufacturing is by an economical refining process from the raw ferrous materials generated in steelmaking.

3 Quality

Table 1 shows the quality and characteristics of the

Table 1 Quality and characteristics of the newly developed iron oxide KH-CP and others of Kawasaki Steel

Characteristics \ Grade		KH-DC	KH-WS (Medium purity)	**KH-CP** (High purity)	KH-UP (High purity)
Fe_2O_3	(%)	≧99.1	≧99.3	≧99.5	≧99.5
Cl	(%)	≦0.10	≦0.05	≦0.05	<0.01
SO_4	(%)	—	—	—	≦0.30
SiO_2	(ppm)	≦ 200	≦ 80	≦ 50	≦ 30
Mn	(ppm)	≦3000	≦3000	≦2500	≦ 300
Al	(ppm)	≦ 200	≦ 200	≦ 80	≦ 10
Ca	(ppm)	≦ 300	≦ 80	≦ 50	≦ 10
Na	(ppm)	≦ 50	≦ 10	≦ 5	≦ 5
Mean particle dia.	(μm)	0.60~1.00	0.45~0.65	0.45~0.65	0.35~0.55

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newly developed KH-CP iron oxide compared with the other grades from Kawasaki Steel, which are KH-DC (normal grade), KH-WS (medium-purity grade), and KH-UP (high-purity grade). KH-CP is the highest-purity grade apart from KH-UP, which is used for special purposes and manufactured in small scale by another method using externally sourced materials. KH-CP is purified by a special refining method that removes many impurities such as silica (SiO_2), sodium (Na), calcium (Ca), aluminium (Al), phosphorus (P), titanium (Ti), and chromium (Cr) more effectively compared with the conventional products. Furthermore, the particle size is fine and uniform.

4 Manufacturing Process

The Kawasaki Steel process for manufacturing the newly developed KH-CP iron oxide and other grades is shown in **Fig. 1**. The manufacturing process for KH-CP from the waste pickling liquor involves refining by reduction-filtration under controlled pH conditions, coprecipitation and adsorption by partial oxidation, and sediment separation. This method makes it possible to purify the pickling liquor effectively and economically.[1]

The commercial plant in Mizushima Works has been in operation since June 1989 and produces iron oxide up to a maximum capacity of 450 t/month.

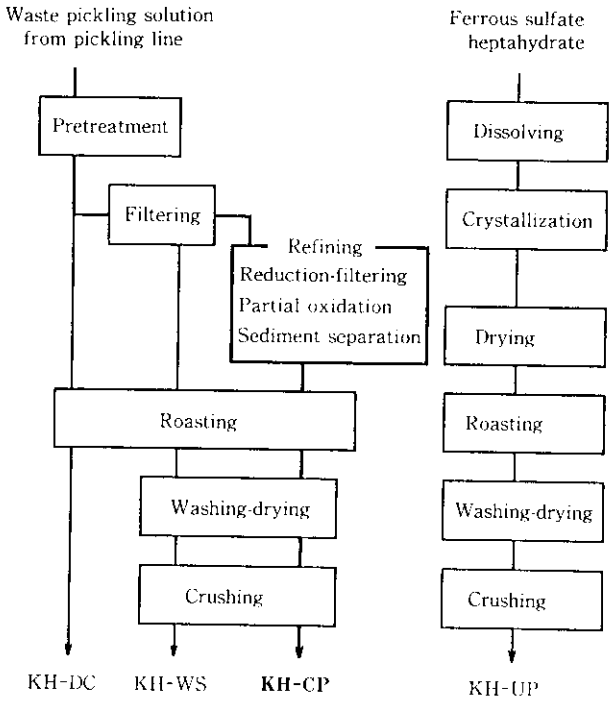

Fig. 1 Process flow chart for manufacturing the newly developed iron oxide KH-CP and others of Kawasaki Steel

5 Use and Performance

The typical use of KH-CP is as a high-quality transformer core for switching power sources. **Figure 2** shows a comparison of a soft ferrite trial core manufactured from KH-CP and two other popular cores in power loss as a typical magnetic property. The lower the power loss, the higher the efficiency and performance of a core is considered to be, so that the trial core manufactured from KH-CP is judged to make notable improvement in performance.

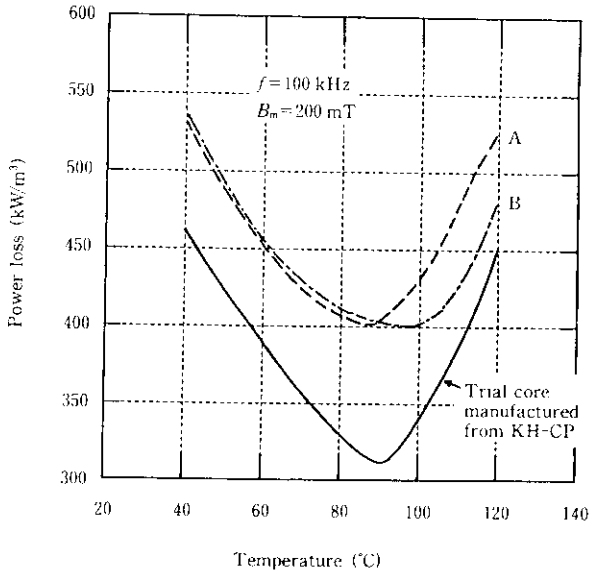

Fig. 2 Comparison of a trial core manufactured from KH-CP with other cores (A, B) widely used

6 Concluding Remarks

KH-CP iron oxide for high-quality soft ferrite which has been recently introduced by Kawasaki Steel's Chemical Division has much lower levels of many impurities compared with the conventional ones. Therefore, soft ferrite products manufactured from KH-CP have superior magnetic properties, especially in power loss. KH-CP has a good cost-performance ratio because of its manufacture by an economical refining process. The quality of KH-CP satisfies the requirements of the main ferrite makers and has earned a high reputation.

Reference

1) Kawasaki Steel Corp.: Jpn. Kokai No. 3-5324

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