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Hitachi Metals, Ltd.

Hitachi Metals Creates New Soft Ferrite Core Material with Outstanding High-Frequency Characteristics

Hitachi Metals, Ltd. is pleased to announce its development of ML91S—a soft ferrite core material engineered to offer outstanding high-frequency characteristics—and a mass production system to supply it. ML91S is expected to play a key role in further downsizing, weight reduction and energy savings in components used in network equipment, automobiles and smartphones.

1. Background

Recent years have brought increasing demands for higher information-processing functions to advance the Internet of Things and the use of big data. Against this backdrop, the need for servers and other network equipment possessing greater capacity and speed has become a key theme. Heightened environmental awareness has also fueled demands for greater energy savings.

Data centers—the core bases for network service support—have a particularly pressing need for better energy efficiency and lower air-conditioning costs. This has prompted calls for network equipment that is smaller in size and generates less waste heat. Raising the frequency and efficiency of semiconductors used in server power sources is another topline goal. Effective solutions are also needed for the transformers, inductors and other passive components these systems use.

With regard to transformers and inductors in particular, shifting from operation in 500 kHz domain switching frequencies to the high-frequency range of several MHz tends to raise core loss[*1] in the materials that are their key components. That lowers power conversion efficiency and generates greater heat. To curb the production of this heat and stabilize the operation of surrounding components, lower core loss when operating at the aforementioned frequency domain is essential.

2. Outline

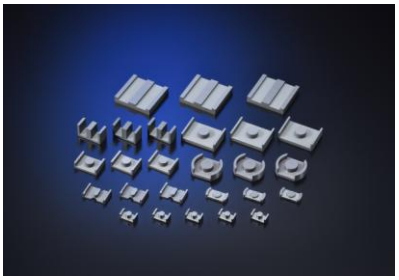

Photo: ML91S—a high-frequency ferrite core material

Created from a manganese-zinc ferrite (Mn-Zn) material, ML91S is a soft ferrite core material that significantly cuts core loss in high-frequency domains (in the 1 to 5 MHz range). The use of Hitachi Metals' original powder metallurgy and heat-treatment technologies has paved the way for this Mn-Zn ferrite material offering higher saturation magnetic flux density[*2] than the Ni-Zn materials normally used in high-frequency domains. Moreover, since the core loss of this new material is so low in high-temperature environments that approach actual use conditions (80 to 100˚C range), it successfully reduces power consumption and curbs heat generation.

Using ML91S satisfies the need for both higher frequencies and lower core loss in transformers and inductors, as well as offering smaller size and enhanced energy savings in network equipment. The scope of applications includes automobile electrical components, mobile terminals and numerous other electronic parts.

Given its outstanding characteristics suited to high-temperature environments, the addition of ML91S to our soft ferrite core materials lineup will allow Hitachi Metals to address an even more extensive range of customer needs. We will continue the quest to design materials that draw out the properties of raw resources, contributing to smaller and lighter electronic components with higher efficiency and reliability.

■ ML91S main features

This material effectively keeps core loss low even at frequencies of 1 to 5 MHz, particularly when operating in high magnetic flux density domains of 50 mT and below.
(Reference: Major reduction in core loss to levels approximately one-tenth those of the existing Hitachi Metals MB28D product line at a frequency of 2 MHz and magnetic flux density of 50 mT [100˚C])

3. Production Status

Mass production system: Fully in place
Production bases: Hitachi Ferrite Electronics, Ltd.
Hitachi Metals Hong Kong Ltd. (Pan Yu Factory)

4. Patents

Applications are pending

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Supplementary Explanations

■ Properties of ML91S High-Frequency Ferrite Core Materials (Typical)

		ML91S (Newly developed)	MB28D (Existing product)
Core loss Frequency: 1 MHz Flux density: 50 mT	100˚C	100 kW/m^3	1,500 kW/m^3
Core loss Frequency: 2 MHz Flux density: 50 mT	100˚C	700 kW/m^3	6,800 kW/m^3
Saturation magnetic flux density	100˚C	435 mT	440 mT
Initial permeability		900	2,800
Electrical resistivity		8.0 Ωm	8.0 Ωm
Curie temperature*3		280˚C	240˚C

Glossary

*1 “Core loss” refers to the loss of energy when magnetic cores are placed in magnetic fields of alternating currents at specific frequencies. Higher core loss leads to higher energy loss.

*2 “Saturation magnetic flux density” is the value that expresses the strength of magnetic force in materials, and is a standard measurement for the performance of magnetic materials. The degree of magnetization exerted on magnetized materials is referred to as magnetic flux density; a higher value leads to the downsizing of cores and application under higher levels of electric current. Saturation magnetic flux density indicates the limit of magnetization on magnetized materials.

*3 “Curie temperature” refers to the transition temperature when a ferromagnetic substance changes into a paramagnetic substance, or when a ferroelectric substance changes into a paraelectric substance.