Sintered Electromagnetic Stainless Steel with High Magnetic Properties: NIKKALOY SUE-2

Technical background

Conventionally, the majority of electromagnetic parts produced by machining wrought stainless steel materials, including solenoid valves, injector cores for fuel injection systems, and other types of actuators, had contained a small amount of added lead (Pb) for improved machinability.

Hitachi Powdered Metals recently developed a new sintered electromagnetic stainless steel material, Nikkaloy SUE-2. The newly-developed product possesses high magnetic properties and is an environment-friendly material which does not require Pb addition because near net shape compacting is possible. It has been adopted for use in injector core parts for LPG vehicles.

Conventional technology

Wrought electromagnetic stainless steel

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Chemical composition	Fe-13Cr-2Al-2Si-0.3Pb
Density (Mg/m^3)	7.6
D.C. magnetic properties	B2500 (T) : 1.38 Br (T) : 0.84 μm : 3000
A.C. magnetic properties Core loss W (W/kg)	1T/50Hz : 12.76 0.05T/5kHz : 47.42 0.05T/10kHz : 135.9
Electrical properties Resistivity ρ μΩ·m	0.72

The conventional product contains a small amount of lead (Pb), which is added to improve cold forgiability and machinability.

New technology

Sintered electromagnetic stainless steel

	SUE-2: Sintered electromagnetic stainless steel
Chemical composition	Fe-6.5Cr-3Si
Density (Mg/m^3)	7.3
D.C. magnetic properties	B2500 (T) : 1.36 Br (T) : 0.81 μm : 4800
A.C. magnetic properties Core loss W (W/kg)	1T/50Hz : 9.48 0.05T/5kHz : 22.02 0.05T/10kHz : 61.34
Electrical properties Resistivity ρ μΩ·m	1.04

Near net shape compacting technology using the powder metallurgy process enables low-cost production of 3-dimensional shapes.

Example of application
(injector core parts for use in LPG vehicle)

Features of the new product

(1) Sintered electromagnetic stainless steel SUE-2 possesses high magnetic/electrical properties, surpassing those of the conventional wrought electromagnetic stainless steel material, which were obtained by optimizing the composition and achieving high density.
(2) Taking advantage of the feature of the powder metallurgy process which enables compacting of near net shape materials, it is possible to produce electromagnetic stainless steel products with 3-dimensional shapes at low cost and with high yield.
(3) The newly-developed product is an environment-friendly Pb-free material.

Possible applications of the new product

- Solenoid valves
- Injector cores for fuel injection systems
- Various types of actuators
- Sensors

Typical applications of the new technology

- Injector cores for LPG vehicles (see above photo)
- Solenoid valves