

Composite Magnetic Parts Using Diffusion Bonding Technique

Technical background

Wrought materials with high wear resistance had been used in armatures for solenoid-type injectors in common rail systems of diesel automobiles. Hitachi Powdered Metals recently developed a high performance composite armature by proper arrangement in the necessary parts of EU-53 material with excellent magnetic properties and a wrought material with high wear resistance using the sinter-diffusion bonding technique, which is a original technology of this company.

Conventional material

Manufacturing method with conventional technology

Manufactured from wrought material by 100% machining.

Problems of conventional technology

Because the conventional manufacturing method was a process of machining from wrought material, the machining allowance was large, and because a single material was used, it was not possible to satisfy both properties of magnetic flux density and wear resistance at a high level.

New technology

Using Hitachi Powdered Metals' proprietary sinter-diffusion bonding technology, two different materials are bonded to form a unitary product. Specifically, in the blade part, in which strong suction and high response are required, EU-53 with high magnetic flux density and high magnetic permeability is used, and in the shaft part, a wrought material with high wear resistance is adopted. The optimum material is arranged in the necessary parts by assembling and bonding these materials, realizing a one-piece composite magnetic part.

Specification of EU-53 material

Chemical composition

Component	Fe	Si	Others
Content (mass%)	Bal.	1.5-3.5	< 2

Magnetic properties

Item	Density [Mg/m ³]	Magnetic flux density B [T]	Maximum magnetic permeability [μ_m]
Property	7.3	1.48	4000

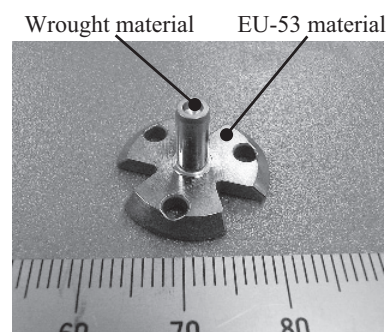
Features of the new technology

- (1) Diffusion bonding between a P/M component and a wrought steel component, or between materials having different functions, is possible.
- (2) Undercut shapes can also be formed by bonding, reducing cost by enabling a reduction of the machining allowance.
- (3) EU-53 material is a high density (7.3Mg/m³) sintered material and possesses high magnetic flux density and high magnetic permeability.

Examples of applicable products

- Various types of actuators such as solenoid valves, etc.
- Composite parts consisting of magnetic materials and non-magnetic materials.
- Composite parts consisting of wrought materials and sintered materials.

Applied products



Armature for injector of diesel automobile