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Effect of Annealing Temperature on Electromagnetic Absorption Properties for FeSiAl Alloy Powder-Polymer Composites

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For the shielding of EM noise, soft magnetic plate-like metal powder-polymer composites have been studied because of their excellent soft magnetic properties such as relative permeability. In order to improve effectively high electromagnetic absorption properties in the radio frequency ror the application of the electromagnetic absorber, we investigated annealing effect of microforged powders on magnetic properties and electromagnetic absorption behaviors of ferromagnetic FeSiAl alloy metal powder-polymer composites in a vacuum furnace from 300℃ to 700℃ for 1 hours under argon gas atmosphere. As a result, the magnetic permeability was considerately increased in the measured frequency owing to microforging process and subsequent annealing treatment. The magnetic permeability of the composites consisting of the microforged powders annealed at 600℃was 60% higher than that of the magnetic composite consisting of the as-microforged powder. The power loss in the far field regime was greatly improved by the microforging and subsequent annealing in frequency range of about 1~2 GHz because of relief to internal strain developed in the microforging process.

that range of frequency. The value of permeability increases with an increase of the permalloy powder content. The core with an addition of 50 wt.% permalloy powder shows stable permeability of about 45 up to 1 MHz. According to the SEM micrograph, the permalloy powders were plastically deformed by compaction. These plastically deformed permalloy powder filled empty space between FeSiB amorphous powders, which can be effective in improving the permeability of the FeSiB amorphous powder cores. However, the addition of permalloy powder deteriorates the frequency dependence of permeability at high content of permalloy powder. The core loss increased as the amount of permalloy powder increased. The increase of core loss is considered to be due to the increase of the eddy current loss caused by inter-particle contact. With an increase of permalloy powder content, electrical contact between non-insulated permalloy powder increases, which results in the increase of eddy current loss. The FeSiB amorphous powder core with an addition permalloy powder shows superior dc-bias properties of 85 % permeability at H=50 Oe.

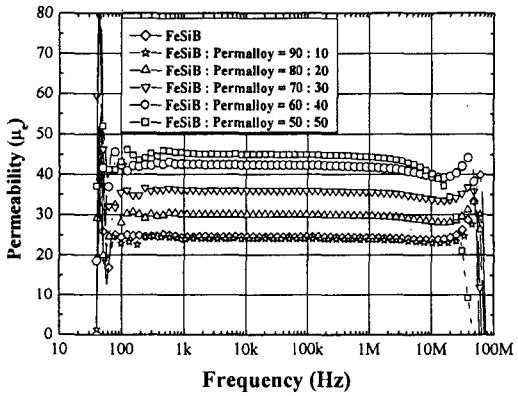

Fig. 1 The effective permeability for FeSiB amorphous powder cores with an addition of permalloy powder.

4. Conclusion

FeSiB amorphous powder with good soft magnetic properties was successfully obtained by high-pressure gas atomization in the particle size range below 75 μm. Permalloy powder as a metallic binder enables consolidation of the FeSiB amorphous powder cores by cold pressing. The addition of permalloy powder increases values of permeability of the cores, but it deteriorates the frequency dependence of permeability at higher content of permalloy powder.

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5. References

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