Low-cost Good-quality Ferrite Materials for the Electronics Industry*

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Introduction

In the electronics industry, ferrite-based circuit components' prices are required to be lowered almost yearly while maintaining or improving their quality. Research-and-development efforts to satisfy these requirements are being pursued mostly by commercial firms and little by non-profit organizations. Therefore a study of magnetic soft ferrites was undertaken for both low-loss and high-loss applications ranging from many types of inductor to deflection yokes to electromagnetic interference suppressors to wide-band transformers. The project's main objective was to create low-cost magnetic soft-ferrite materials of good quality for a wide range of electronic applications.

Materials and Methods

Various formulations were attempted, each requiring a combination of some of the following metallic-oxide raw materials: NiO, MgO, MnO, ZnO, Fe2O3, CoO, CuO, La2O3, Al2O3, SnO2, TiO2 and Y2O3. The purity requirements were not very stringent i.e. the oxides were only needed to be about 99.1% pure. The conventional ceramic fabrication technology was employed which involved oxide mixing, presintering, grinding and granulating, pressing to shape and final sintering. The main preparation parameters were the mixing and grinding time, the (pre)sintering time and the (pre)sintering temperature, the sintering atmosphere being ambient air for NiZn and MgZn ferrites and oxy- gen / nitrogen for MnZn ferrites. Mea- surement of properties was conducted on toroidal samples, covering the initial permeability, relative loss factor, impedance, hysteresis parameters, Curie temperature, density, grain size and pore size. These properties were compared with those of commercial soft-ferrite materials, taking similarity of application as the basis of comparison.

Results and Discussion

Many of the material formulations attempted in this project were useful for a wide range of magnetic cores in electronic applications. The NiZn ferrite materials are suitable for both low-loss and high-loss applications, which include electromagnetic interference suppressors, inductors, antennas and wideband transformers. Comparisons with products of some major producers show that some of the materials are superior to those available on the soft-ferrite market, besides being of lower costs.

For MgZn ferrite materials, those suitable for TV and computer-monitor deflection yokes are among the project's best achievements. Again a comparison was made with yoke cores of major producers, showing very successful results in terms of required properties and costs. The MgZn ferrite materials also include very low-cost materials for inductors and electromagnetic interference suppressors.

The MnZn ferrite materials fabricated in this project have properties suitable for inductors and wideband transformers. The material costs for these materials are low; however, the processing cost is similar to that of commercial materials.

Conclusions

Low-cost and good-quality soft ferrite materials have been produced for applications including electromagnetic interference suppressors, TV and computer-monitor deflection yokes, wide-band transformer cores and a wide range of inductors and antennas.

Benefits from the study

The findings from this project can now be transferred to a manufacturing concern. Already, the Malaysian Technology Development Corporation has approved a product development grant for producing ferrite products based on the results of this work.

Project Publications in Refereed Journals

None.

Project Publications in Conference Proceedings

None.

Graduate Research

Masdhiah Masphol. 2001. Inductors [MS]. Universiti Putra Malaysia.

Lucia Liew Woan Shyan. 2000. Ferrite multilayer inductors [MS]. Universiti Putra Malaysia.

Tan Thien Khoon. 2000 Inductors [MS]. Universiti Putra Malaysia.

Thor Soo Fung. 2000 TV and computer-monitor deflection yoke materials [MS]. Universiti Putra Malaysia.

Zahi., S. 2000. Ferrite inductors [MS]. Universiti Putra Malaysia.

Zolman Har. I. 2000. Electromagnetic interference materials [PhD]. Universiti Putra Malaysia.

Noorhana Yahya. 1997 Low-loss inductors and antennas [MS]. Universiti Putra Malaysia.

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