PROPERTIES AND APPLICATIONS OF MICROWAVE ABSORBING PAPERS

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Introduction

The synthesized ferrite was coated on the papers for applications as microwave absorbing papers [1]. Papers have been usually used for writing, packing, liquid absorption and so on. However, recently, the developments of technology and industry have led to EMI (electromagnetic interference) problems, therefore, application of papers for new functions such as various specialty paper or high performance paper with microwave absorption have been required.

Here, we report a manufacture process of microwave absorbing papers and those properties. The coated papers by microwave absorption materials were characterized by XRD, VSM, FE-SEM, and Network analyzer. We suggest that our papers can be applied as candidate for industry, national defense.

Experiments and Results

As coating materials on the papers, a sample of $Ni_{0.65}Zn_{0.35}Cu_{0.1}Fe_{1.9}O_4$ compositions was prepared by ball-mill method; appropriate portions of NiO, ZnO, CuO, and Fe_2O_3 were mixed in distilled water and methanol by the rotation of roller. The mixed powder was dried at 120 ℃ in air, calcined at 800 ℃ in air, and then sintered at 1100 ℃ in air [1].

Surface coating was necessary to introduce the ferrite powder on a paper. A 55 g/m^2 paper was used as base paper. Latex was used as a binder with the ratio of 50 wt % for the ferrite. Furthermore, carbon and pigment (TiO_2) had been added as additives on the ratio of 100 wt % for the ferrite. The coating solutions were prepared by first dispersing the solution in distilled water with a high shear, then, the binder was added to the solution. The ferrite powder was added in a produced coating solution and coated on a base paper using laboratory Bar-coater. It was dried for 60 second at 80℃ in air.

The raw material of $Ni_{0.65}Zn_{0.35}Cu_{0.1}Fe_{1.9}O_4$ – rubber composite was pelletized with thickness of 2.22 mm by the press and coated papers were made of ring shape with outside diameter = 7 mm and inside diameter = 3 mm, for a measurement on the microwave absorbing characteristics [2-3].

The XRD patterns of each sample were shown in Fig. 1. The crystal structure of $Ni_{0.65}Zn_{0.35}Cu_{0.1}Fe_{1.9}O_4$ was cubic spinel structure and lattice parameter was a=8.389 Å. The coated papers by ferrite were detected peaks of base paper (M), carbon (C), and pigment (P)

phase. Therefore, we suggest that new chemical reaction is not for the process of the coating. In the raw material (K4), reflection loss(dB) was detected a maximum value of 28.2 dB at 11.9 GHz, it could be considered that it was commonly used in the range from 11.7 ~ 12.3 GHz. In coated papers, only ferrite paper (FP ; K1) and ferrite-carbon paper (FCP ; K2) had very a little valuable reflection loss, but ferrite-conductive pigment paper (FPP ; K3) had a maximum value of 7.6 dB at 17.5 GHz.

From the VSM results, because the ratio of ferrite was increasing, the magnetization of each sample had increased, and the uniformity of coating on papers was very hard from the FE-SEM results. It is enough to use for microwave absorption papers and a new type.

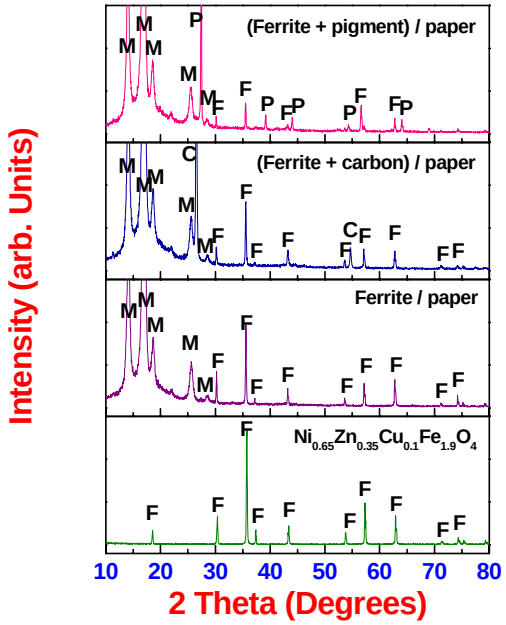

Fig. 1. XRD patterns of raw material and coated papers. No other phase was detected from the new chemical reaction. Ferrite(F), base paper(M), carbon(C), and pigment(P).

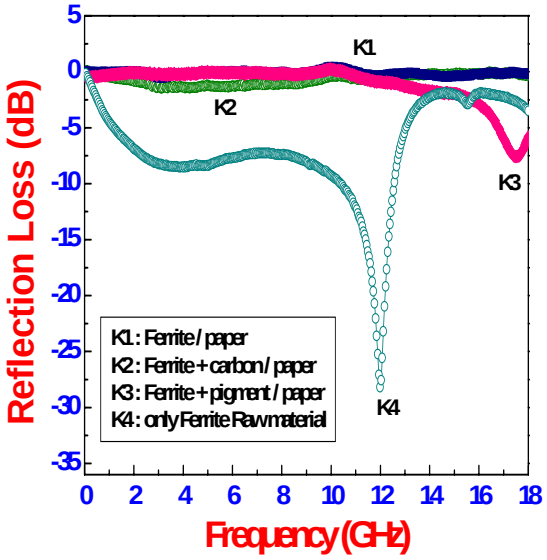

Fig. 2. The microwave absorbing characteristics of the ferrite-rubber and coated absorbing papers.

References

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