

Errata to “FORMULATION OF SCREEN PRINTED COBALT NANO PARTICLES INK FOR HIGH FREQUENCY APPLICATIONS”

by M. Nelo, A. Sowpati, V. K. Palukuru, J. Juuti, and H. Jantunen,
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Previous ink characterization results published in the paper are corrected by new characterization measurements from Co inks based on same cobalt nanoparticles bound together with poly(methyl methacrylate). New measurements results are reported as vol% whereas previous results were reported as wt.%. Correlations are 30 vol% = ~80 wt.%, 40 vol% = ~86 wt.% and 50 vol% = ~90 wt.%.

- 1) Page 253, “The relative permeability of the thick film patterns with good printability was measured with a shorted microstrip structure over the frequency range of 0.2 to 4 GHz” should be replaced with The relative permeability of the thick film patterns with good printability was measured with a shorted microstrip structure over the frequency range of **0.2 to 5 GHz**”.
- 2) Page 253, “The ink attained real part of complex permeability values of up to 5.13 at 200 MHz with 70 wt.% of magnetic filler” should be replaced with “The ink attained real part of complex permeability values of up to **2.55 at 2 GHz** with 50 vol% of magnetic filler”.
- 3) Page 254, last paragraph. [14–17] should be replaced with **[14–22]**.
- 4) Page 262, second paragraph. “with different amounts of filler in the frequency range “0.2 to 4 GHz” are shown in Figure 10 and Figure 11” should be replaced with “with different amounts of filler in the frequency range **0.2 to 5 GHz**” are shown in Figure 10 and Figure 11.
- 5) Page 262, second paragraph. “The real part of the relative permeability was 5.13, 3.95 and 2.36 at 200 MHz for 70 wt.% , 60 wt.% and 50 wt.% of filler loading” should be replaced with “The real part of the relative permeability was **2.55, 2.35 and 2.2** at 2 GHz for 50 vol%, 40 vol% and 30 vol% of filler loading”, as shown in Figure 10.
- 6) Page 263, Figures 10 and 11 need to be changed with **modified Figure 10**.
- 7) Pages 263 and 264, I would like to **remove the following** (equations and some text because it is difficult to conclude what happens to the ferromagnetic resonances. Somebody can see frequency movement, but it is not clear).

According to the LandauLifchitz Gilbert theory, the ferromagenetic resonance of a magnetic film can be defined as [15]

$$f_R = \frac{\gamma}{2\pi} \mu_0 \sqrt{H_S M_A} \quad (11)$$

where H_S is the saturation magnetic filed, M_A is the anisotropic constant, γ is the gyromagnetic ratio.

Further, from constituent relations,

$$B = \mu H_S \quad (12)$$

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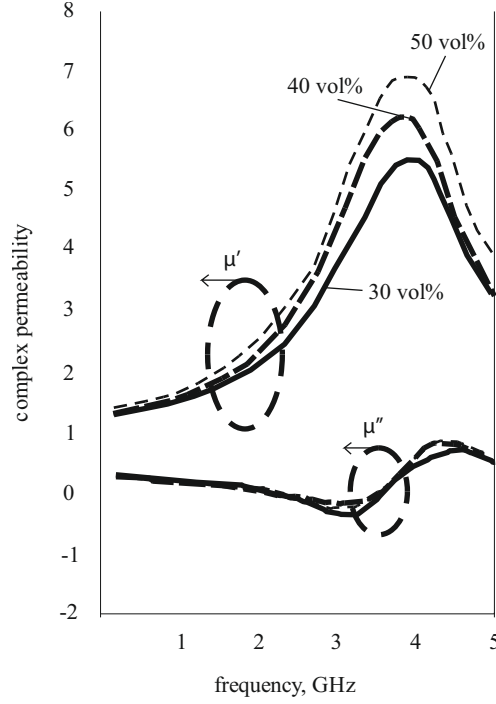


Figure 10. The complex permeability of the printed cobalt magnetic thick films.

Hence, from Equations (11) and (12) one can deduce that,

$$f_R \propto \frac{1}{\sqrt{\mu}} \quad (13)$$

Thus, ferromagnetic resonant frequency is inversely proportional to square root of magnetic permeability of the magnetic film. With the increase of cobalt filler loading levels in the printed film, the permeability of the film increases, thus the FMR of the film decreases.

- 8) Page 264, “Ferromagnetic resonances of the fixture loaded with the sample were measured at 1.71 GHz, 1.86 GHz and 2 GHz for 70, 60 and 50 wt.% filler loading levels” should be replaced with “Ferromagnetic resonances of the fixture loaded with the sample were measured at **4.2, 4.1 and 4 GHz** for 50 vol%, 40 vol% and 30 vol% filler loading levels”.
- 9) Page 264, in acknowledgements, I would like to thank Dr. Sami Myllymaki for his support and helpful discussions during making corrections.
- 10) Page 266, we would like to add following references:
 - [20] Wu, M., Y. D Zhang, S. Hui, T. D. Xiao, S. Ge, W. A. Hines, J. I. Budnick, and G. W. Taylor, “Microwave magnetic properties of Co50/(SiO2)50 nanoparticles,” *Applied Physics Letters*, Vol. 80, 4404–4406, 2002.
 - [21] Kato, Y., S. Sugimoto, K. Shinohara, N. Tezuka, T. Kagotani, and K. Inomata, “Magnetic properties and microwave absorption properties of polymer-protected cobalt nanoparticles,” *Materials Transactions*, Vol. 43, No. 3, 406–409, 2002.
 - [22] Chung, J.-Y., K. Sertel, and J. L. Volakis, “Broadband characterization of bulk and thin magnetic composites using stripline structures,” *IEEE Transactions on Microwave Theory and Techniques*, Vol. 58, No. 11, 2960–2967, Nov. 2010.