

Referee's report of the Thesis

„Engineering of Polymer Magnetic Composites with Controlled Electromagnetic Properties“.
by Vladimir Babayan, M.Sc.

The Thesis deals with development of novel polymer-ferrite composites focusing on absorption of electromagnetic radiation in radiofrequency range. The aims of the Thesis correspond to the actual trends in the research of polymer magnetic composites containing fine magnetic particles with core-shell structure. The work was carried out under supervision of Assoc. Prof. Natalia Kazantseva, Ph.D. at the Faculty of Technology of the Tomas Bata University in Zlín.

The Thesis is based on four papers in international journals dealing with the results which constitute the main content of the Thesis. Vladimir Babayan is the co-author of the papers, however, his role and share in the group of all authors is not given in the Thesis. The materials investigated in the Thesis were prepared from polymers and manganese-zinc ferrite. I am not able to evaluate the material processing because my knowledge and experiences are not satisfied in this field. The author varied parameters of composite preparations and subsequently studied changes in electromagnetic properties of the materials. He considered that the substantial effect on changes of composite properties was caused by magnetoelastic strains in the ferrite particles. The strains induced an increase in magnetocrystalline anisotropy which finally increased coercivity, thermal stability of magnetic properties and a shift of the magnetic dispersion region towards an ultrahigh frequency band. These knowledge and new information could be used for focused proposals of improved absorbers of radiofrequency radiation in different ranges of operating frequencies.

Polymers which can be applied in development of organic magnets based on polyaniline in various oxidation and protonation states were chosen as the second class of materials investigated in Thesis. The main goal of this research was focused on the study of possible mechanisms of magnetic ordering in these materials.

The Thesis contents eight chapters. It is not easy to separate information which is obtained from the publications of the other authors and the results obtained by author's PhD study. The main comments to the results published in the attached journal publications can be found in 7th chapter.

The Thesis contains results and publications which were referred by the journal referees. The final technical arrangement of the Thesis is a good level which meets the requirements of Tomas Bata University.

Comments and questions.

1. In chapter 4.1., several models for mixing rules are mentioned. Their comparison from the point of view of the results described in the Thesis should be done by the author.
2. How influence changes in the distance between ferrite particles due to polymer coatings magnetic properties of the composite?

3. Is there an experimental proof for the model given in Fig. 20? The pictures taken using AFM are not sufficient as a proof. The author should show a model of the magnetic domain structure in the case when magnetic domain walls do not terminate on the surface of the ferrite particles?
4. The author should estimate (calculate) the strain which would produce the change of 1 % of magnetocrystalline anisotropy constants and make a comparison with parameters of the mechanical properties of the ferrite and polyaniline. This question is focused on the statement in the last row in page 43 on induction of elastic strains in ferrite particles.

The Thesis by Vladimir Babayan is focused on modern problems in the basic research which have direct connections to applications in praxis. The goals of the Thesis were defined clearly. For the fulfillment of the tasks the author has used his abilities for experimental work, analysis and scientific discussion of the yielded data. He published with co-authors the results in international journals and at international conferences.

Conclusion.

I can state that Thesis by Vladimir Babayan has very good quality. He has shown his research abilities in the field of materials science, independence in the scientific work including of publication of the results. The Thesis completes the standard requirements and therefore I recommend the Thesis for the defense.

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