

Dissertation thesis

Anju, M.Sc.

„Preparation and characterization of advanced spinel ferrite nanocomposites for electromagnetic applications“

Anju's work focused to study of a high performance electromagnetic (EM) wave absorber with strong dielectric and magnetic losses. Polymer composites with conducting fillers, (e.g. spinel ferrites, graphene, reduced graphene oxide) can be a good candidates for their electric and magnetic properties, and a good chemical stability for minimizing of electromagnetic interference (EMI).

The theoretical part (23 pages) is focused to theoretical background of EMI shielding (reflection, multiple reflection, absorption, skin effect), a study of EMI properties (electric conductivity, dielectric and magnetic losses, etc.), and to construction of EMI shielding materials of polymer nanocomposites (novel magnetic and conducting fillers). It is based on a search of 29 international publications and a review article (marked as [A4] in the thesis), on which she is a co-author. (CRITICAL REVIEWS IN SOLID STATE AND MATERIALS SCIENCES, 2023, VOL. 48, NO. 4, 441–479).

The Debye model of dielectric permittivity is discussed in this part (Eqs. 2.8 – 2.11, but the Eqs. 2.8 and 2.9 are the same). I think that missing similar simple model for magnetic permeability (e.g. Lorentz resonance model). But there are many other models of permittivity and permeability. Can you discuss some of these? Why this described theory did not used for interpretation of dielectric and magnetic properties in experimental part.

Experimental part consists two chapters (Experimental methods – 8 pages and Results and discussions – 85 pages). The complex results of three groups studied materials are presented in this part:

1. Thermoplastic polyurethane with magnetic nanoparticles and reduced graphene oxide (TPU- $\text{Co}_x\text{Zn}_y\text{Fe}_z\text{-rGO}$), (published by author in [A1] of the thesis)
2. Thermoplastic polyurethane with magnetic nanoparticles and reduced graphene oxide (TPU- $\text{Cu}_x\text{Co}_{1-x}\text{-Fe}_2\text{O}_4\text{-rGO}$), (published by author in [A2] of the thesis)
3. Thermoplastic polyurethane with magnetic nanoparticles and graphene oxide (TPU- $\text{CoFe}_2\text{O}_4\text{-GO}$), (published by author in [A3] of the thesis)

I see the shortcoming of this part in the fact that the specific instruments on which the experiments (e.g. XRD, Raman, FTIR, XPS) were carried out are not listed, but above all the impedance methods determining the permittivity and permeability of materials. I assume it was a network analyzer Agilent N5230A and parameters (permittivity and permeability) were calculated by Nicolson-Ross-Weir method from scattering parameters. Did you try to analyze results (e.g. from Figures 5.14 and 5.15). I think that interpretation is not simple, because

Cole-Cole (with high letter because these are the names of scientists) diagrams are more complicated. On the other hand, I find the explanation of the mechanisms in Figures 5.17, 5.31, and 5.46 to be very illustrative.

In the last chapter, the conclusions that emerged from the own work and comments on individual publications are presented. I would be interested in which parts of the work the author devoted herself to, where her main contribution is. The Anju lists 4 publications in which she participated (three of them as the first author). In WoS there are 7 publications in four years (2020 - 2024), the number of citations is 67, and her h-index is 5.

However, in spite of these comments, I consider the work of Anju M.Sc. as useful, especially in terms of the topicality of the issue and direct orientation into practice.

Since Anju M.Sc. proved the prerequisites for independent creative activity, I recommend accepting her dissertation thesis to defend in the field of study "Nano technology and advanced materials", and award she the title of Ph.D.

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