Review of dissertation

Name of student: Yousef Murtaja
Title: Self-organized biopolymer layers and coatings with mineral fillers for special applications
Supervisor: prof. Ing. Lubomír Lapčík, Ph.D.
Field of study: Nanomaterial Chemistry
Place: Department of Physical Chemistry, Palacký University, Olomouc

Basic characteristics

The dissertation consists of 94 pages, 47 figures, 11 Tables, 225 references; 5 original articles were enclosed as well. The dissertation is not clearly separated into theoretical and experimental parts (chapter 12 "Projects"). The chapter 10 is linked to an article entitled "Intelligent high-tech coating of natural biopolymer layers" and, thus seems to be experimental and better placed in the chapter 12.

The dissertation is focused on the synthesis and mechanical testing of polymer composite materials. The obtained experimental results have been published in 3 peer-review journals indexed in the Web of Science: Advances in Colloid and Interface Science (IF 15.6), Nanotechnology Reviews (IF 7.4), and Materials (IF 3.4). Due to the demanding peer-review processes of these journals I have only several general questions and comments, see below.

Questions and comments

1. Figures 20, 28, 29, and others: Curves on these figures have minima and maxima which are not explained in the text. Have these curves any analytical definitions?
2. What are the optimal or maximal contents of the fillers in the polymer matrixes?
3. Why $CaCO_3$ was used as a filler for HDPE? Is this composite a nanomaterial?
4. What kinds of clays were used for the experiments? Were they exfoliated in the polymer matrixes?
5. Page 56, It is given: "Furthermore, it was observed that both nanocomposites showed enhanced thermal stability when compared to virgin HDPE, suggesting a far more robust bond with the HDPE matrix." There are no results concerning the thermal stability in this chapter.
6. Part 12.4, It is not clear to me whether this chapter is related to the topics of the dissertation.
7. Page 71, The FTIR analysis was mention here but I did not find any FTIR spectra.
8. The structures of the nanocomposites were not studied by e.g., XRD, FTIR, and XPS. Specific surface area and pore size distributions could be also useful for this research.
9. Each of the attached articles has several co-authors. Please, clarify your contribution.
10. Please, explain the practical application of your work.

Conclusion

The results in the dissertation are original and have been already published in peer-reviewed scientific journals. Therefore, **I recommend the dissertation for its public defence.**

Ostrava, December 11, 2023

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