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Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Mohammad Owais

PhD Program: Materials Science and Engineering

Title of Thesis: Design and characterization of thermally conductive polymer nanocomposites with tunable electrical resistivity

Supervisor: Dr. Sergey Abaimov, Skoltech

Name of the Reviewer:

I confirm the absence of any conflict of interest	**Date: 01-09-2023**

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

This thesis has carried out comprehensive experimental studies on synthesis, thermal and electrical characterizations of several types of nanofiller modified polymer composites. The thesis is well organized, and the contents is relevant to the topic. The experimental methods is reasonable and the results can support the conclusions effectively. The author gives detailed analysis of the fundamental mechanism underlying experimental phenomena, and comments the potential applications of each nanocomposite. The author has published three journal and one conference papers, and I think these good publications has demonstrated the scientific importance of this thesis.

Other comments on this thesis are listed as follows,

(1) There are some typing errors in publication list.

(2) In chapter 3, the author interprets the effects of BN content on the overall TC (Fig. 7) in the view of homogenous dispersion and nano-level structure. It may be more convincing if the author can give some SEM pictures corresponding to different BN contents, such as those in Fig. 6. I think it can better help readers to under the interpretation.

The author believe that the ratio of 2:1 is an optimum ratio by comparing three different ratios. Has the author tried the ratio smaller than 2:1, e.g. 1:1?

The same questions for the investigations of electrical resistivity.

A minor question: the four subpictures in Fig. 5 corresponds to the BN/PVA ratio of 0:1, 9:3, 9:1 and 2:1, respectively. But the sequence of the four ratios are different in Figs. 7 and 8.

(3) In chapter 5, for the two types of MWCNTs, the size of CNT agglomerates seems to has no significant on the electrical and thermal conductivity of nanocomposite according to the experimental results in this thesis, can we have a such a conclusion? Or are there some other factors leading to such experimental results, e.g. the poor impregnation of epoxy into CNT agglomerates? Especially, as shown in Fig.4, increasing the content of MWCNTs has very limited effects on TC of nanocomposites. I think the author would add some interpretation to address the effects of the dispersion and contents of MW1 and MW2 which have been obtained in this work.

As there are a great number of report in literatures, it is better to give some comparisons between the present results with those in literatures, especially for the effects of MWCNT agglomerates, which could help the author to better interpret the present experimental results.

Provisional Recommendation

☑ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*

☐ *I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report*

☐ *The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense*