

Dissertation review report

"The application of plasma treated polyethylene and glass fibres in composites and sandwiches prepared via rotational molding"

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1. Achievement of the dissertation objectives

The objectives of the dissertation were summarized in four basic points (brief summary): (a) the optimization of the rotational molding process of plasma treated polyethylene samples prepared at different peak internal air temperature (PIAT) and testing these samples, (b) the experimental determination of plasma treated polyethylene (PE) effect on the adhesion between PE and polyurethane (PU) foam in sandwich structure – mechanical properties, (c) the preparation and analysis of composites created by plasma treated PE and glass fibres (GF) – influence of different plasma treatment time of PE and GF, influence of treated and untreated PE blends on mechanical properties of final composites, etc., (d) to demonstrate the possibilities of applications of these materials and composites in industry.

The choice of objectives corresponds to the purpose of the dissertations, i.e. to advance the current state of knowledge in the field. Moreover, the topic of dissertation is a long-studied problem at the Department of Materials Engineering, FME, CTU in Prague. There is no doubt that the objectives have been met and the thesis is a valuable contribution not only for the research community, but the results will find their application in industry, which is undoubtedly success for a graduate in a technical field.

2. Elaboration of the state of art in theoretical part of dissertation

The current state of knowledge in the dissertation is written clearly and in logical chapters. The doctoral candidate cites a rather extensive set of publications, the summary of which shows that his topic is up to date. In my opinion, the chapter on "interface and adhesion" could be a bit more extensive given that these are key material properties in this thesis.

3. Theoretical and practical contribution of dissertation

The scientific contribution of the dissertation is unquestionable. The dissertation is beneficial in the field of applied surface science, especially for the preparation of composites and sandwich structures.

4. Suitability of the solution methods used and how they were applied

The student had to prepare a significant number of samples - for rotational moulding, PE/PU sandwiches, glass fibre composites. In addition, the student also prepared some samples directly at Olivo cold logistic, a company that manufactures food transport containers from PE/PU composites. The student tested mainly the mechanical properties of the prepared composites – Young's modulus, flexural modulus, Charpy impact test, de-bonding test (PE/PU sandwiches). The methods used were all

correctly applied to demonstrate the positive effect of plasma-treated polyethylene on the adhesive and mechanical properties of the fabricated composite samples.

5. Formal level of dissertation

From a formal point of view, the thesis is written quite well. The chapters are logically connected to each other and the reader can easily navigate through the text. There are a tolerable number of typos in the text. Occasionally, the author makes errors in the literature cited. For example, in the cited publication no. 74, text refers to Zuzana et al., which is the first name and not the last name of the author of the publication.

6. Questions

1) On page 53 of figure 43 there are relatively large standard deviations of PU residues for 100% treated powder content. The same problem is in figure 50. How many samples were used for the measurements?

2) On page 90 you write that it would be possible to use plasma-treated polyethylene powders for 3D printing. Could you explain this idea?

7. Conclusion

Dissertation Ing. Zoya Ghanem fully meets the requirements for this type of thesis within the meaning of Act No. 137/2016 Coll. on Higher Education. The student has clearly demonstrated the ability of creative work and independent scientific activity. Therefore, I recommend to accept this thesis for further proceedings and after successful defence to award the Ph.D. (philosophiæ doctor) degree.

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