

A review of  
**„PROCESSING, STRUCTURE AND PROPERTIES OF COMPOSITES BASED ON  
NATURAL FILLERS AND STEREOREGULAR POLYOLEFINS:  
ENVIRONMENTALLY BENIGN CONCEPT“**

by

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The thesis is focused on wooden plastic composites (WPC) with respect to the relation among structure and processing properties. The works addressing environmentally benign concept are nowadays very demanding in the application sphere, and therefore the topic of the PhD work has been well selected.

Research has been carried out within joint degree PhD program of the Université Blaise Pascal, Aubière, France and Tomas Bata University in Zlín, Faculty of Technology, Zlín, Czech Republic on the basis of long term cooperation between both institutions. At this point I recommend providing thesis with the list of the detailed description of the individual contributions of the participating laboratories.

The *Introduction* presents an overview of the materials and techniques employed in the thesis. However, the chapter 2.1.1. Properties of Wood Plastic Composites is rather a mess of methods and treatment, where only polypropylene (PP) and maleic anhydride treatment is considered. For the state-of-art I expect more deep introduction to the topic - are there another polymer matrices used for WPC, other treatments concerning adhesion to wooden particles, papers devoted to viscoelastic properties of WPC, e.t.c.? Some statements in the Introduction are meaningless (e.g. p. 19 “Wood can differ in *many properties* accordingly to the age of tree, portion, *mechanical properties* and others.”). Often rather general or obvious is presented without deeper insight. Also, some information is repeated within the same paragraph (e.g. p. 19: “Hardwood is porous material, which consists of vessel elements. These two different kinds of wood differ also in their anatomy. Hardwood is porous containing vessel elements, whereas softwood is non-porous.”)

Chapter 2.1.2 Processing of Wood Plastic Composites – at least a brief comment on single/twin extrusion or other methods employed should be given in relation to the work published in the area of WPC. What are the advantages/disadvantages for WPC?

Chapter 2.1.3 Applications of Wood Plastic Composites - reference to the WPC usage is more than 10 years old – is there more actual information?

Concerning the formal style of the thesis I would expect redrawing instead of copying the schematic figures, e.g. Figs. 9 and 10. Then the style could be unified. Papers addressed in the thesis are also not without errors (e.g. p.13 reference Bouafif et.al without numbering, p. 28 Addink and Beitema the reference completely missing).

The following chapter *Materials and Experimental Techniques* gives the summary of the materials, testing equipment and methods. Is the scheme of DSC thermogram (Figure 18) typical for PP? This section also requires a thorough formal revision – the symbols in Eq. (1) and (2) in relation to (4) to (6)? Where is meaning of  $\gamma_c$  presented in Eqs. 5 and 6? Even the definition of Hook and Newton laws are not plausible, and should be revised in order to convince the reader about the state of knowledge of the PhD applicant.

There are typing errors and inaccuracies through the thesis which should be eliminated, especially if they appear in the List of Abbreviations (what is the meaning of “real viscosity” or “imaginary viscosity”?  $G'$  is not loss modulus, and vice versa  $G''$  is not a storage one!!, tau used as a symbol of relaxation time, but within a text  $\lambda$  is employed). Sometimes even the term “elastic viscosity “ is used (e.g. p. 45, Figs. 27-29)!! The typing of symbols should be unified – *italic* not only in equations but also within a text, and vice versa (e.g. p. 27 you have in *italic* the units). The English of certain should be revised too, especially omit Czech words, (e.g. titanium, not titan, p. 23).

The molecular weights of PP were measured by the applicant or obtained from the manufacturer? If the latter applies, then it should be mentioned within the text.

Could you comment on the limit of the linear viscoelastic region for the materials tested? Especially, do they vary with the molecular weight of PP used or the loading level of wood? At what strain the tests were performed?

Some comments to *Results and Discussion*:

Could you explain the reason of using weight % instead of volume % in case of wood plastic composites?

Please comment on changes in character of viscoelastic functions (e.g. Fig. 22 the slope of 40 and 50 % loading, plateau in imaginary part of complex viscosity) instead of rather general description that some curves are “higher/lower” or “dramatically changed”. You should provide the hypotheses supported by the literature sources and explain the behaviour obtained!

I miss completely the comparison of pure PPs involved in the study. How the fact that both real and imaginary parts of complex viscosity of PP(1) are more than one order of magnitude higher than other PP will affect the viscoelastic behaviour of the composites?

How would you explain the ordering of the real part of complex viscosity (dynamic viscosity) for 5 to 15 % loading of PP(12) and PP(20)?

I do not agree with the conclusions on p. 44: "The composites with PP(27) indicate almost the same viscosity as composite with PP(20)". Even more, why PP(27) was selected for the following study on various woods, when PP(20) follows better your conclusions concerning the interactions?

Why frequency 0.2 rad/s was selected for the detailed study of the filler concentration (p.45) – it seems to be rather unstable region according to Figs. 25, 27, 28, 29.

What do you mean by conclusion on p. 46: "The polymer matrix with higher MFI brings a superior possibility of incorporation of WF to the matrix."

On p. 52 to the Figures 35 and 36: "There are recorded no differences in the type of the filler even in the size of filler particles." - what do you mean with this conclusion, especially in case of 10 % loading?

Why MFI has been related to the viscoelastic behaviour - and thus rheological property (one point on the flow curve) was related to other rheological properties - instead of molecular weight?

Finally, many formal errors, e.g. text to Fig 26, or two types of description of axes – e.g. Fig. 35 vs. Fig. 37 – which of them is a correct one?

Conclusion of the thesis – I think it could be made only in case that also mechanical properties would be measured and support the results. Overall, the section Conclusions should be rewritten according to the previous comments and following revision of the thesis.

This thesis presents very interesting data on the subject, which however have to be discussed more thoroughly with comprehensive references to the previous research in the field. I recommend the thesis for the defense of PhD. degree or "le grade de DOCTEUR D'UNIVERSITE" by the Université Blaise Pascal and Tomas Bata University in Zlin during which Kristýna Berková shall demonstrate her ability to conduct careful and well-oriented scientific research to a satisfactory level.

In Zlín May 29, 2013

  
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