

## Investigation of polymer melt flow through different mixing elements and waving screw channels

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The thesis focuses on single screw extrusion particularly on the mixing ability of the screws with specifically optimized elements. Such a topic is certainly highly actual - to understand fully the mixing principles is a key for a design of the screws and set-up of the polymer processing leading at the end to polymeric products with higher added value fulfilling continuously increasing quality requirements.

The thesis consists of 132 pages and is prepared with the approach of combining abstract, theoretical introduction, summary of the papers, aims, conclusions and the scientific articles themselves. Three papers have been published (or will be) in the scientific journals (1 published, 1 accepted, 1 submitted) and one paper is a conference fulltext contribution (Antec 2010).

The *Abstract* introduces the problem and individual parts of the thesis. Unfortunately, the Author has not used the titles of the individual chapters therein (eg. in the first view the reader believes that the expression "*Theoretical background/Teoretická část*" equals probably to Introduction (Teoretická část = Introduction). Then, it is not clear what and where is "*experimentální část*" (Paragraph 3 in the Abstract). The Abstract also mentions (Paragraph 2) that the part of the theoretical introduction deals with the description of some methods of mixing quantification. The reader can however find this very briefly (!) just in the Conclusions. Consequently, it appears that the most probably the expression "*theoretical background/teoretická část*" in the Abstract refers to almost whole part of the thesis until the collection of published papers. This creates difficulties for reading of the thesis and also decreases the impact of the chapter The Aims.

In the Chapter 2, Mixing principles, the Author mentions that the dominant factor responsible for mixing in polymer processing is convection. There are indeed also some important thermodynamical factors behind the polymer mixing which the Author could discuss during the thesis defence. Also, more details about the experimental approach and mixing quantification relevant for the thesis should be provided.

The Papers themselves passed through demanding referee assessment and it is not necessary to discuss them thoroughly. The Author should however consider the quality of the graphical reprints, eg. in the Paper 1, Fig. 6 or Fig. 13. Also, more detailed information regarding the used materials could be provided (low viscosity LLDPE, high viscosity HDPE, LDPE) including more detailed characteristics of the colorant. The assessment of the mixing ability is performed via the grayscale image analysis using the graphical outputs of the inline melt camera system. If there is a need for more exact color matching of the final product could you imagine the approaches how to handle?

The thesis favourably combines the assessment of practical industrial problems with their modelling and analytical interpretation helping to understand complicated processes proceeding during the material melting and transport on the screw. Most of the work have already been published in the scientific articles and presented at the conferences. Also, two Author's works have been awarded by the SPE as the Papers of the Month (April 2011 and March 2014). I can thus agree with defence of the thesis.

In Zlín, 30.9.2014



Martin Obadal