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EVALUATION OF THE PH.D. THESIS ENTITLED

"Multicomponental polyurethane systems with targeted properties. Preparation and characterization"

presented by

Eng. Magdalena Serkis-Rodzeń, MSc

to the Charles University, Faculty of Science, Department of Physical
and Macromolecular Chemistry

The Ph.D. Thesis of Magdalena Serkis-Rodzeń deals with the design and optimization of synthetic protocols to receive exclusively aliphatic polyurethanes (PUs). Further it concerns of preparation and characterization of polyurethane water dispersions (PUD) and their organic-inorganic silica nanoassemblies with the aim of forming polyurethane films (coatings) with desirable properties (biostable or biodegradable PU). The study is motivated by the current lack of environmentally friendly methods for preparation of PUD and is showing a perspective to overcome this problem.

The Thesis is divided into five parts: The first chapter brings a detailed and well-written overview on the physicochemical properties and application of polyurethanes: water dispersions, biostable and biodegradable thermoplastic elastomers and their composites. Next parts briefly describe characterization methods used by Ph.D. candidate in her research work (light scattering, atomic force and scanning electron microscopy, tensile test and dynamic mechanical thermal analysis). Such a diversity of used advanced characterization techniques allows Ph.D. candidate to achieve very interesting and valuable findings described in chapter Results and discussion and to express reasonable conclusions described in the following chapter.

The research results were extensively published in internationally recognized impacted journals. The Thesis is based on six papers published in *J. Appl. Polym Sci., Compos. Interfaces, 2x Prog. Org. Coat., and 2x Polym. Degrad. Stabil.* Magdalena Serkis-Rodzeń is the first author of five of these papers and simultaneously corresponding author in three of these papers, which is showing Ph.D. candidates significant engagement in the formation of these articles. In any case, a brief description of the contribution of all co-authors to the common articles should be specified. In addition, Magdalena Serkis-Rodzeń successfully participated in other research projects that resulted in four further publications not included in the Thesis so the overall publication records during her Ph.D. studies are outstanding.

In the Thesis I found several misprints, discrepancies and grammatical errors:
- Front page in Summary of the Ph.D. Thesis (Autoreferát): "Univerzita Karlova v Praze", "Charles University in Prague" it should be Univerzita Karlova and Charles University respectively, p.30 position 27. is missing
- Abstract "for improve" should be to improve
- p.10 and p.41 "diskusion" should be discussion

- p.20 "phoshene" should be phosgene
- p.20 "mnbiocompatible" should be biocompatible
- p.20 "temperature limits for working" ?
- p.23 "since the past 20 year" it should be for the past 20 years
- p.47 "To assume" should be to summarize, to sum up
- p.47 "to recycling" should be to recycle
- p.48 "Scheme 5", "Scheme 5a) and b)", "Scheme 5c" should be Scheme 6, Scheme 6a) and b), Scheme 6c respectively
- p.55 "To assume the paper III" should be to summarize, to sum up
- p.62 "formed spherical formation" ?
- p.64 "was based beside on"?
- p.66 "To summary, the paper V" should be to summarize

However, the above-mentioned misprints or grammatical errors do not affect much my overall positive opinion on this Thesis. Having no general objections to the contents of the Thesis, I would like to ask Ph.D. candidate to comment on the following points:

1) According to IUPAC Recommendations polymer degradation is a chemical change in a polymeric material that usually results in undesirable changes in the in-use properties of the material i.e. 1. Degradation is accompanied by a decrease in molar mass. In some cases degradation means changes in chemical structure. It can also be accompanied by crosslinking, 2. Degradation results in the loss of, or deterioration in, useful properties of the material. Last part of the Thesis deals with polymer degradation and stability of PU films and is giving answer only to the second point of IUPAC recommendations. I would like to ask how you would design experiments to answer first part concerning decrease in molar mass of your PU films during degradation.

2) In Introductory part we learned about chain extender. On page 20 it is stated: "The lack of a chain extender in PU structure leads to physically poor materials, often without microstructure separation.", however in Article IV we read "…we fully eliminated the chain extension step. This approach enabled the acquisition of materials with reduced toxicity, manufacturing cost, and energy consumption" Is PU in this case also a poor material?

3) To determine the size of PUD you have been using AFM, SEM and DLS that are giving different results, why is this so, could you please comment on that?

4) Why the Berry plot instead of the standard Zimm plot has been used to evaluate SLS data in article IV?

In summary I can only express my positive opinion about the research work presented in the Thesis that represents a significant contribution in material science of polymers and I strongly support its acceptance for public defense and awarding Magdalena Serkis-Rodzeń the Ph.D. title.

Prague, June 5, 2017   Eng. Mariusz Uchman, Ph.D.