

Würzburg, 30.08.2018

Expert Review on the dissertation
„Magnetorheological Systems with Optimized Performance“
by
Ing. Martin Cvek

Magnetorheological materials are materials, which rheological properties can be tuned by a magnetic field. Such materials are interesting for a great variety of applications, for example for adaptive dampening systems. Mr. Cvek initially reviews the background and state of the art in magnetorheology in a clear and concise manner. From the perspective of a polymer chemist, one might argue that the background regarding the surface initiated polymerization was maybe a bit short. For the present reviewer, it would have been interesting what specific improvement the current work was expected to bring compared to the work by Evrensel and co-workers (Polymer 2006, ref. 126). From the scientific literature and its development over the years, it is clear that magnetorheological systems remain a topic of great interest in research, as Mr. Cvek nicely points out. The aims of this work were manifold. Among others, different shells of the carbonyliron (CI) nanoparticles, synthesized by atom transfer radical polymerization, were targeted to increase their performance and stability in magnetorheological suspensions and elastomers, respectively.

Accordingly, Mr. Cvek starts his results section with the description of the polymer shell via ATRP, which requires priming the particles with the corresponding initiators. Overall, 4 different modifications were realized, specifically two different chain lengths using two different monomers. In my opinion, this low number of systems is certainly at the lower limit to allow any systemic investigations. Regarding the results discussed in chapter 3.3., it would have been highly beneficial, if Mr. Cvek would have given information as to what dispersant was used for the experiments. This information is given in the corresponding publication, but it would have been good to also include it in the synopsis, if only for the benefit of the reader. Nevertheless, it is clear that the modification improves the sedimentation stability and only minimally affects the MR effect. In the following, the candidate investigates MREs modified with the respective particles. Somewhat unexpected, the storage

modulus was highest for the non-modified particles. The candidate mentioned that the cavities found in SEM images might be detrimental for long-time performance. It would have been interesting to read whether the candidate has found experimental indication for this statement. However, the relative MR effect was found increased for the modified particles. Regarding Figure 199 (which should read 19), the differences in the observed shear stress are rather minor. I am wondering if these difference can be strictly related to differences in the materials or might actually also, at least, in part, the difficult quantitative reproducibility of rheological experiments

Finally, a number of questions remained for me, including the following:

Question 1: Regarding the data presented in Figure 12: The weight loss for bare CI presented here, was here the acid-treated CI used or the untreated? What effects may the acid treated elicit?

Question 2: I find it difficult to concur with the assessment that the coating is homogenous from the data presented in Figure 10. Was this investigated more comprehensively? If yes, how? If no, why not?

Question 3: Page 44/45: In what way is PHEMATMS multifunctional?

Question 4: From Figure 4 it is apparent, that the overall mass that sediments is lower for coated particles, however, the initial slope seems little affected. Would not a different slope be expected?

Question 5: Page 40: Why did the author expect that the molar mass of the polymer grafts affect the sedimentation stability?

Overall, it is my opinion that the submitted work is fully suitable and sufficient as a Ph.D. thesis. My recommendation to the Study Discipline Committee is to accept the work of Ing. Martin Cvek Ph.D. thesis without any reservations.



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