Review of Doctoral Thesis

Title: **Ionic Polyacetylene Type Polymers and Polymer Networks by Catalyst-Free Quaternization Polymerization**

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The reviewed doctoral thesis deals with synthesis and characterization of novel ionic π-conjugated poly (mono –, and disubstituted acetylene) type of materials via quaternization polymerization of pyridine based monomers in a presence of various types of alkyl halides as quaternization agent. This thesis was composed of three manuscripts published in reputed journals, thus their scientific relevance and novelty can be expected.

The thesis consists of 193 pages divided into 9 main chapters.

The first chapter brings extensive introduction into the field of polyacetylene type of polymers, Meshutkin reaction and quaternization polymerization of vinyl – and ethylpyridines. The introductory part is more than sufficient from both qualitative and quantitative point of view.

The aims of the work are defined in the second chapter. Their specifications are clear and they correspond to the projects implemented at the Department Physical and Macromolecular Chemistry.

The chapter 3 describes materials and methodology used within the experimental part. In my opinion this part is too extent and unnecessarily detailed. On the contrary, the elemental analysis procedure is specified just by name of the operator and address of the laboratory. Please reveal the type of the device used for the analysis during the presentation.

Results and discussion part presented in chapter 4 is divided into 2 subchapters. While the subchapter 4.1 describes experimental data on monosubstituted ionic polyacetylenes, the

subchapter 4.2 is focused on disubstituted ionic polyacetylene based polymers and networks. The latter mentioned subchapter is subdivided on two parts dealing with quaternization polymerization of disubstituted monomers with non-symmetrical and symmetrical substitution, respectively.

Conclusions shown in the chapter 5 summarize the highlights of the experimental work. In some cases, it copies the text already shown in the abstract. Contribution of this PhD project to science and/or practice should be included here or inserted as an individual chapter. Furthermore, some of the analytical techniques were carried out by other researchers, including results interpretation (see pages 69-73). The contribution of the student to the presented results as well as the overall contribution of this work to the given field should be emphasized during the presentation or subsequent discussion.

Remaining text consists of list of abbreviations (chapter 6), impressive list of 233 references (chapter 7), list of publications (chapter 8) and attachments (chapter 9).

In spite of the formal comments, the reviewed thesis can be considered as well prepared and its quality entirely fulfils the demands placed on PhD theses. On the basis of that it is my pleasure to recommend Mgr. Tomáš Faukner for the award of the PhD degree.

Further questions for the discussion part are the following:

1) The ionic nature of the prepared polymers is responsible for their enhanced solubility in polar solvents. Is it positive characteristics or not? How could it influence the potential applicability of these polymers in practice?

2) Please compare the key properties and perspectives of your newly synthesized ionic polyacetylenes with respect to other conductive polymers, e.g. polythiophene or polyaniline based polymers.

3) Why was the SEC analysis related to PMMA standards? Would be the PS standard more appropriate?

4) How was the solubility evaluated (Tables 3, 10 and 16)? Did the synthesized polymer networks show swelling behaviour in the relevant solvents?

5) TGA analyses were carried out under nitrogen atmosphere and the thermal stability was evaluated on the basis of temperature when 5 % weight loss occurred and the same at 800 °C (pages 163-165). Would be the same trend observed in the presence of air? Please discuss the significant weight loss at 800 °C differences for the polymers poly(4PD) and poly(2PD).

In Zlín, 16 August 2016.

doc. Ing. Vladimír Sedlařík, Ph.D.