CHARLES UNIVERSITY
Faculty of science

EVALUATION OF THE PH.D. THESIS:

"Oriented copolymers with liquid crystalline building blocks"

presented by

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

The present Ph.D. Thesis written by Eng. Sabina Jolanta Horodecka, M.Sc. under the supervision of Dr. Adam Strachota deals with a new class of smart nanomaterials, reversible physical networks which are based on hydrosilylation chemistry of polydimethylsiloxane (PDMS) chains and six new liquid crystalline (LC) structural units obtained for this research work via international collaboration with Rzeszow University of Technology.

The dissertation has a structure typical for this type of work. In particular, a comprehensive introduction very well prepares the reader to follow and understand the rest of the work. The clear and detailed objectives of the work are presented in the second chapter followed by a detailed description of experimental section. The Results and Discussion part is based on six papers thematically closely related and perfectly composed for the doctoral dissertation with Eng. S. J. Horodecka as a first author. Three of them were recently published in internationally recognized, impacted journals (*European Polymer Journal* and *Polymers*). Three other papers are about to be submitted for publication soon. The contribution of all coauthors to those papers is discussed in separate chapter Statement about work contribution. The dissertation is completed highlighting the implications of the findings and explaining the importance of the work in Conclusions chapter. It is worth mentioning that Eng. S. J. Horodecka also successfully participated in another research project that recently resulted in publication in *Reactive & Functional Polymers* journal that is not a part of the dissertation.

Eng. S. J. Horodecka dealt in particular with: the synthesis and thoughtful characterization of the obtained copolymers. She prepared a library of new copolymers by fine-tuning their architecture. Three different types can be distinguished: (1) LC-grafted PDMS (with LC quartets at the grafting sites), (2) LC-end-capped linear PDMS, (3) and linear 'infinite' LC-PDMS copolymers (with alternating LC and PDMS segments). The research questions postulated in the Thesis are approached with great care by Ph.D. candidate. To answer them precisely several advanced characterization techniques such as GPC, NMR, MALDI ToF (to study copolymers molar masses and dispersity), DSC, WAXS, SAXS, PLM, thermo-mechanical analysis (DMTA), advanced tests of mechanical and rheological properties (strain sweep tests, creep test, stress relaxation, frequency stiffening tests and ability to self-healing, reversible gelation near the melting point, rate of thermally induced physical gelation and thixotropic properties has been conducted thoroughly. All this enabled Ph.D. candidate to achieve many interesting and valuable findings and to formulate important and convincing conclusions about structure-properties relationship of new copolymers with liquid crystalline building blocks**.**

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I found few imperfections of the text of the dissertation:
page 17 ‘PDMS spacers of different lengths of were tested‘
page 23 ‘mas’ missing s, 3 should be in superscripts, some parentheses brackets are missing
page 60 Figure 3 text in the Figure overlapping
page 89 equation for scattering vector, *q*: editing problem?
page 109 ‘copolylymer’
page 147 ‘points at a a looser packing‘
page 149 ‘lamellae of BAKU units‘ instead of BAFKU
page 185 ‘‘isotropic temperature’ of of the respective‘
Appendix 6: Mesogen M32 at some point is named M3 only (in Figures of thermo-mechanical properties and GPC traces)

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. What kind of chemistry should be used to achieve real infinite, well-defined, linear copolymers of PDMS and mesogen (despite the disadvantages of such copolymers discussed already in the Thesis).

2. According to IUPAC recommendation “Dispersity” is the new word coined to replace the misleading, but widely used term “polydispersity index” https://doi.org/10.1002/pi.2748. This point is somewhat mentioned in the Thesis, right away on page 23, however later on page 86, 122, 123, 124, the term “polydispersity index” or “polydispersity” is used. The only correct one is “Dispersity”.

3. Orientation behavior of azobenzene containing copolymers can be also controlled by light irradiation. These moieties can undergo a *cis–trans* isomerization causing change in their size and conformation in the co-polymers. This phenomenon was not discussed in the Thesis. How pronounced will the effect of irradiation of certain wavelengths be on yours smart materials?

4. Application of liquid crystalline (LC) materials in a flexible display device is challenging, because the bending of LC displays easily causes change in thickness of the LC layer and of its orientation, resulting in deterioration of image quality. Can you foresee application of your materials in such devices? If so, which one would you select as most promising one and why?

To sum up the above, it is my pleasure to express a positive opinion about the volume and variety of high-quality research work presented in the Thesis, which represents a significant contribution in material science of polymers, and I strongly support its acceptance for public defense and awarding Eng. Sabina Jolanta Horodecka, M.Sc. the Ph.D. title.

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