



Doctoral Thesis Referee Report

PhD student	Manfred Karras
Address	Faculty of Science, University of Potsdam, Karl-Liebknecht-Str. 24-25, 144 76 Golm
Doctoral Thesis	"Synthesis of Enantiomerically Pure Helical Aromatics Such As NHC Ligands and Their Use in Asymmetric Catalysis."
Referee	Assoc. Prof. RNDr. Jan Veselý, Ph.D.
Address	Faculty of Science, Charles University, Hlavova 2030, 128 43 Praha 2

The submitted doctoral thesis deals with the preparation of enantiomerically pure 2-amino[6]helicene derivatives, their metal complexes and their evaluation as catalysts in enantioselective transformations. The first part of the work is focused on synthesis of 2-amino[6]helicene, monobenzo 2-amino[6]helicene and related 2-amino[6]helicene-like compound (134) using simplified synthetic route. Next part deals with the preparation of one-helicene and two-helicene imidazolium salts using Herrmann and Fürstner method, respectively. Subsequently, preparation of metal complexes with Ag, Ru and Pd was accomplished. Last part is focused on application of prepared helicene-derived complexes in enantioselective Ni-catalyzed cyclootrimerization, Ru-catalyzed asymmetric olefin metathesis and isomerization of triynes, and asymmetric Suzuki-Miyaura coupling using novel Pd-PEPSI complexes .

The thesis consists of six chapters (Introduction, Objectives, Results and Discussion, Conclusion and Outlook, Experimental and Literature) and covers 121 pages. It is written with a good level of English with the limited number of typos and misspellings. The text is logically constructed and sufficiently accompanied with the graphical material. Introduction part gives a detailed overview of helicenes and N-heterocyclic carbenes, their synthesis and application. Goals are clearly formulated in chapter Objectives. Chapter 3 (Results and Discussion) is logically divided into six sections following the works on the project and sufficiently discussing the work done. Achievements are summarized in the following chapter. The experimental part (Chapter 5) comprises a detailed description of carried out experiments. The compounds prepared are characterized in a comprehensive way. The PhD thesis contains 156 citations.

At this point, I would like to stress the scientific outcome of the work presented. The thesis combines the three areas (helicenes, NHCs and enantioselective catalysis) in developing a new field of research in asymmetric methodologies, when a new class of catalysts,



helicene-bearing NHC complexes, were designed, synthesized and evaluated. It can be assumed a sufficient number of following works in near future due to promising results obtained with complex **147** in asymmetric olefin metathesis. Based on that I highly appreciate this work even the results in asymmetric transformations did not reach the level of efficiency of catalysts announced previously. It was a real pleasure for me to be a referee of this highly up-to-date thesis.

Selected errors and inaccuracies appearing in the text:

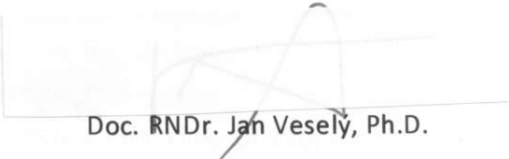
page 18	should be thalidomide
page 22, fig. 12	Projection formula of Pd catalysts could be uniform.
page 57, fig. 14	Projection formula of Ru catalyst should follow the DFT model.
page 34, sch. 22	The scheme do not follow text part, when condition b) were used.
page 52, sch. 42	Projection formulas of cyclopentenes could be better.
page 78-79	Ee of 86 is missing.

(The above list of errors is only indicative and not exhaustive.)

Questions and notes:

- 1) Double Boc-protected aniline **106** was planned for the synthesis of unit **111**. Why Boc-protection was designed and not the corresponding dibenzylated aniline that is related to the previously used compound **rac-81**?
- 2) Why the reaction of **129** with **rac-126** was not tested for preparation of unit **131**?
- 3) It would be beneficial to confirm structure of prepared complexes, such as compound **141**, with X-ray analysis. Have you tried to prepare appropriate crystals from prepared complexes? Has been done any progress in this area since the thesis was completed?
- 4) Do you have any explanation, why transmetallation of **143** does not proceed (Scheme 38)?
- 5) Did you test the activity of prepared helicene-bearing NHCs as organocatalysts? Is it planned to be tested in the future?

In conclusion, I would like to note, that the results of the thesis are original and with high scientific value. The aims stated in the thesis were reached and the main results of the work were published in three peer-reviewed journals (*Chem. Eur. J.*, *Chem. Commun.*, *J. Org. Chem.*). In my opinion, the thesis fulfills the requirements posed on thesis aimed at obtaining the academic degree PhD. I recommend the submitted work as a basis for the defense.


Doc. RNDr. Jan Vesely, Ph.D.

address: Hlavova 2030, 12800 Praha 2
TAX N. : 00216208, VAT N. :
CZ00216208

phone: +420 221 951 305
fax: +420 221 951 226

e-mail: jxvesely@natur.cuni.cz
web: <http://orgchem.cz/vesely>