

Theoretical Challenges of Enantioselectivity in Asymmetric Hydrogenation of Benzofurans Catalyzed by a Bulky Ruthenium-NHC complex

Andrea Hamza

Theoretical Chemistry Research Group, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Magyar tudósok körútja 2., 1117 Budapest, Hungary

hamza.andrea@ttk.mta.hu, hmzandrea28@gmail.com

The asymmetric hydrogenation of aromatic compounds is the most straightforward synthetic method to obtain saturated cyclic molecules, which are present in many biologically active systems. A highly versatile chiral ruthenium NHC catalyst proved to be very effective for the enantioselective hydrogenation of a large series of heteroaromatics[1]. In spite of the extensive structural investigations performed for the hydrogenation of 2-methylbenzofuran[2], the mode of action of the catalyst still remains unexplored.

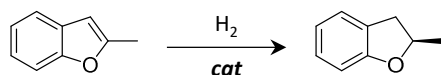


Figure 1: The reaction studied

The aim of our theoretical study was to gain a better insight into the structure of the active catalyst as well as, to elaborate the reaction mechanism for this system.

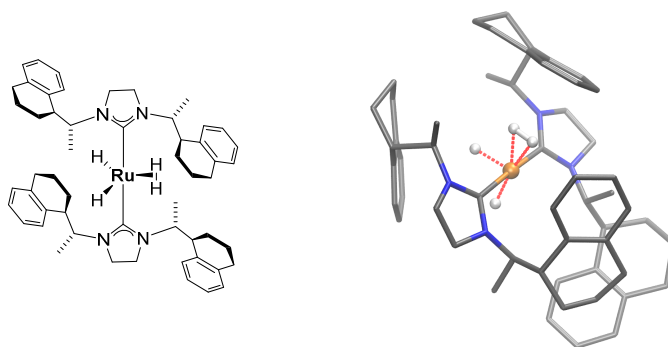


Figure 2: Proposed and computed structures of the active catalyst.

Several isomers and conformations have been considered to identify the most likely form of the catalyst. We proposed a feasible reaction mechanism and all elementary steps and reaction intermediates have been calculated. The most important feature of this system is the different structure of the catalyst toward the two enantiomeric products (“pocket” vs. “flat” conformation). We showed that in spite of the complex conformational space of the bulky ligands of ruthenium these typical forms are inherited through the whole mechanistic pathway. The experimental enantioselectivity has been qualitatively reproduced by our calculations[3].

References

1. N. Ortega, S. Urban, B. Beiring and F. Glorius, *Angew. Chem., Int. Ed.* **51** (2012), 1710.
2. D. Paul, B. Beiring, M. Plois, N. Ortega, S. Kock, D. Schlüns, J. Neugebauer, R. Wolf and F. Glorius, *Oganometallics* **35** (2016), 3641.
3. *Manuscript in preparation.*