Influence of Ligands on the Stereoselectivity of a Cyclization Reaction

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The asymmetric 1,6-enyne-cycloisomerization reaction allows for the synthesis of biologically active cyclopropane compounds.[1] This reaction employs a rhodium-based catalyst with an N-heterocyclic carbene (NHC) ligand with varying side chains. Density Functional Theory (DFT) was utilized to assess the impact of these side chains on the reaction.

The investigated reaction mechanism follows the three-step mechanism described by T. Nishimura, wherein annulation occurs at the second step.[1] The metal center acts as an electrophile here and activates the triple bond of the reactant. The reaction barriers increase in height for larger side chains at the NHC ligand as steric hindrances increase and stabilizing interactions decrease. The energy difference between these barriers also increases with ligand size, resulting in an increase in enantioselectivity. In contrast, no such correlation could be found with the electronic influence of the NHC ligand.

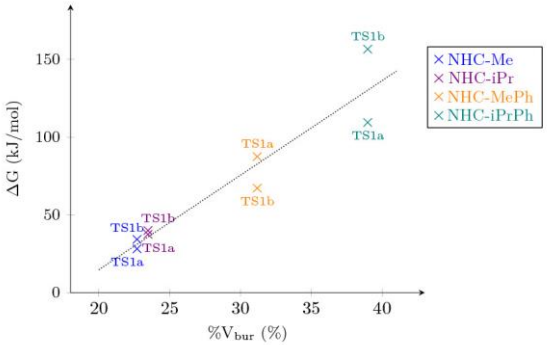

Figure 1: Graph of the energy of the first transition states for all NHC ligands plotted against their 'buried volume'. A linear fit function is employed to better visualize the trend. The values for the 'buried Volume' are taken from H. Clavier *et al.* [2]

[1] T. Nishimura *et al.*, ASC, 2013, **355**, 1374-1382, 10.1002/adsc.201300148.
[2] H. Clavier *et al.*, ChemComm, 2010, **46**, 841-861, 10.1039/b922984a.