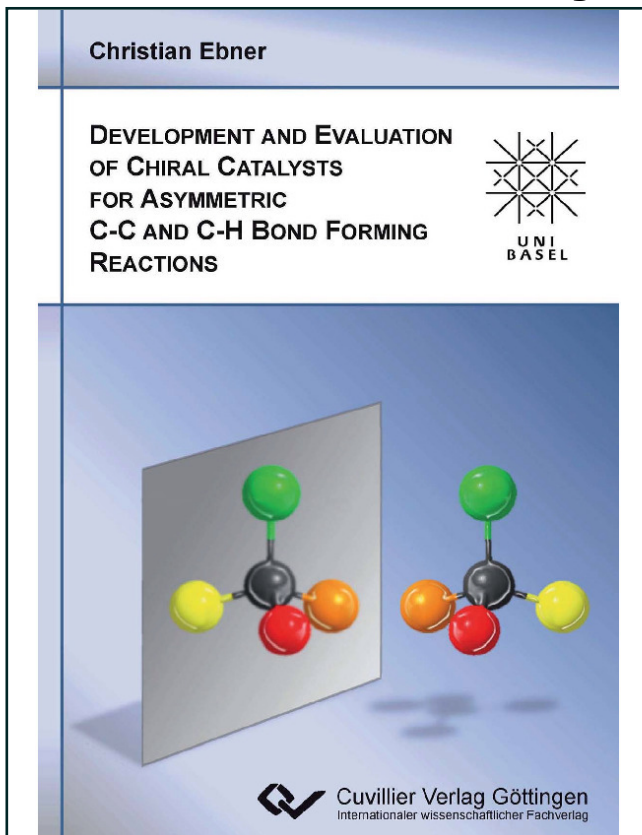




Christian Ebner (Autor)

Development and Evaluation of Chiral Catalysts for Asymmetric C-C and C-H Bond forming Reactions



<https://cuvillier.de/de/shop/publications/82>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen,
Germany

Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>



Table of Contents

1	ESI-MS Screening of Racemic Catalyst Mixtures	1
1.1	Introduction	3
1.1.1	Previously Reported Approaches Towards Selectivity Determination by Testing Racemates.....	3
1.1.2	ESI-MS Screening of Enantiopure Catalysts	7
1.1.3	Objectives of This Work	12
1.2	The Concept of Testing Racemic Catalyst Mixtures by ESI-MS Screening.....	13
1.2.1	Relation Between Catalyst Selectivity and Detected Intermediate Ratio	13
1.2.2	Sensitivity of the Method and Choice of Substrate Ratio	14
1.3	Synthesis.....	16
1.3.1	Substrate Synthesis.....	16
1.3.2	Catalyst Synthesis	17
1.4	Screening Results	31
1.4.1	Screening Conditions	31
1.4.2	Screening of Racemic Aryl-Dimethyl-PHOX Ligands.....	32
1.4.3	Verification of the Results Obtained for Racemic Ph-PHOX and Aryl-Dimethyl-PHOX Ligands	35
1.4.4	Screening of Racemic Aryl-PHOX Ligands	37
1.4.5	Elucidation of the Reason for the Difference Between the Results Obtained from Racemic and Enantiopure Catalyst Screening	39
1.5	Summary and Outlook.....	41
2	New PHOX Containing Catalysts for the Iridium-Catalyzed Asymmetric Hydrogenation	43
2.1	Introduction	45
2.1.1	Historical Overview	45



2.1.2	Objectives of This Work	45
2.2	Catalyst Synthesis.....	46
2.3	Hydrogenation Results	48
2.4	Summary.....	53
3	Secondary Phosphin oxide Containing Ligands in the Palladium Catalyzed Allylic Substitution	55
3.1	Introduction	57
3.1.1	Properties of Secondary Phosphine Oxides	57
3.1.2	Application of Secondary Phosphine Oxides in Catalysis	57
3.1.3	Objectives of This Work	59
3.2	Secondary Phosphine Oxide, Nitrogen Based Ligands	60
3.2.1	Synthesis.....	60
3.2.2	Catalysis Results	60
3.2.3	Complexation Behavior.....	61
3.3	Secondary Phosphine Oxide, Phosphine Based Ligands.....	65
3.3.1	Catalysis Results	65
3.3.2	Complexation Behavior.....	67
3.4	Summary.....	70
4	Organo-Catalyzed Transfer-Hydrogenation of α,β-Unsaturated Carbonyl Compounds.....	71
4.1	Introduction	73
4.1.1	Organo Catalysis	73
4.1.2	Organo Catalyzed Transfer-Hydrogenation	74
4.1.3	Objectives of This Work	75
4.2	Chiral Dihydrobenzo[1,4]oxazines as New Organo-Catalysts	76
4.3	Synthesis.....	78
4.3.1	Catalyst Synthesis	78



4.3.2	Substrate Synthesis.....	79
4.4	Hydrogenation Results	81
4.4.1	Hydrogenation of β -Methyl Cinnamaldehyde	81
4.4.2	Hydrogenation of α -Methyl Cinnamaldehyde	83
4.4.3	Hydrogenation of α,β -Unsaturated Ketones	84
4.4.4	Hydrogenation of β,β -Diaryl Acryl Aldehydes	85
4.5	Summary and Outlook.....	90
5	Mechanistic Investigations on the Organo-Catalyzed Conjugate Addition Reaction	91
5.1	Introduction	93
5.1.1	Peptides in Asymmetric Catalysis.....	93
5.1.2	Tripeptide Catalyzed Conjugate Addition Reaction of Aldehydes to Nitroolefins.....	94
5.1.3	Objectives of This Work	95
5.2	Mechanism Studies.....	97
5.2.1	Investigating the Forward Reaction	97
5.2.2	Investigating the Back Reaction.....	98
5.3	Summary and Outlook.....	103
6	α-Allylation of Carbonyl Compounds by Palladium-Enamine Tandem Catalysis.....	105
6.1	Introduction	107
6.1.1	α -Allylation of via Preformation Activated Carbonyl Compounds.....	107
6.1.2	α -Allylation of via Tandem Catalysis	108
6.1.3	Objectives of This Work	110
6.2	Synthesis.....	111
6.3	α -Allylation of Ketones.....	114



6.4	α -Allylation of Aldehydes.....	126
6.5	Development of a Bifunctional Tandem Catalyst	131
6.6	Summary and Outlook.....	135
7	Experimental	137
7.1	Working Techniques and Reagents	139
7.2	Analytical Methods.....	139
7.3	ESI-MS Screening of Racemic Catalyst Mixtures	142
7.3.1	Substrate Synthesis.....	142
7.3.2	Ligand Synthesis	148
7.3.3	ESI-MS Screening of Racemic Catalyst Mixtures	173
7.4	New PHOX Containing Catalysts for the Iridium-Catalyzed Asymmetric Hydrogenation.....	174
7.4.1	Complexation	174
7.4.2	Hydrogenations	174
7.4.3	Analytical Data of the Hydrogenation Substrates	175
7.5	Secondary Phosphin oxide Containing Ligands in the Palladium Catalyzed Allylic Substitution.....	177
7.5.1	Palladium Catalyzed Allylic Alkylation	177
7.5.2	Determination of Complexation Pattern by ESI-MS	177
7.6	Organo-Catalyzed Transfer-Hydrogenation of α,β -Unsaturated Carbonyl Compounds.....	178
7.6.1	Catalyst Synthesis	178
7.6.2	Substrate Synthesis.....	188
7.6.3	Organocatalyzed Transfer Hydrogenation	205
7.7	Mechanistic Investigations on the Organo-Catalyzed Conjugate Addition Reaction.....	210
7.7.1	ESI-MS Analysis of the Forward Reaction.....	210



7.7.2	ESI-MS Analysis of the Back Reaction	210
7.7.3	Selectivity Determination by ESI-MS Screening of the Back Reaction	210
7.8	α -Allylation of Carbonyl Compounds by Palladium-Enamine Tandem Catalysis .	211
7.8.1	Catalyst Synthesis	211
7.8.2	α -Allylation of Carbonyl Compounds	213
8	Appendix	217
8.1	Derivation of the Formula for Selectivity Calculation for the ESI-MS Screening of Racemic Catalyst Mixtures	219
8.2	Summary of Screening Results Obtained from the ESI-MS Racemate Screening .	222
8.3	Crystallographic Data	224
8.4	List of Abbreviations	225
9	References	229
10	Summary	237