Streszczenie w języku angielskim

The aim of the doctoral dissertation entitled “Modern methods of synthesis of metalloidoorganic compounds catalyzed by pincer cobalt complexes” was to develop efficient and selective methods for the synthesis of organometallic compounds, carried out under mild conditions and without generating toxic by–products. The research focused on using low–cost cobalt catalysts based on the triazine backbone, which enabled the efficient synthesis of compounds with potential applications in the pharmaceutical and polymer industries.

In the course of the research, a hypothesis was proposed that the appropriate choice of reactants and reaction conditions would enable the discovery of new procedures for the synthesis of organosilicon and organoboron compounds. The obtained pincer cobalt complexes were subjected to catalytic tests, which showed that primary silanes and pinacolborane effectively activate them, eliminating the necessity of using strong bases for this purpose. The developed synthetic routes enabled efficient synthesis of the compounds, while their further functionalization, confirmed the high applicability of the designed methods. The products were characterized by NMR spectroscopy, mass spectrometry, and other techniques.

This doctoral dissertation describes catalytic methods for the functionalization of silylacetylenes, alkenes, allenes, and aldehydes based on dehydrogenative borylation, hydroboration, and hydrosilylation reactions. The results obtained were presented in the form of four scientific publications (**P1–P4**).

The first publication in the series (**P1**) describes three methods developed for the functionalization of silylacetylenes using pincer cobalt complexes, enabling control of the reaction direction depending on the substituent at the aromatic ring. Complex **F**, activated with pinacolborane, leads selectively to hydroboration products in the case of bulky silylacetylenes, while complex **E** enables dehydrogenative borylation. Moreover, for non–bulky silylacetylenes, the addition of cesium carbonate improves their conversions, allowing *E*–isomers to be obtained with high yields. These protocols provide bifunctional organosilicon and organoboron compounds, whose high utility was confirmed in three further functionalizations, highlighting the great application potential of the developed method. A possible activation mechanism was proposed based on NMR experiments and literature data.

The second publication in the series (**P2**) concerns two newly designed methods for hydroboration of terminal alkenes using developed cobalt catalysts. These protocols enable the functionalization of a wide range of unsaturated derivatives of amines, silanes, ethers, or natural products, maintaining high chemo– and regioselectivity. The study demonstrates the unique selectivity of the system, enabling selective functionalization of vinyl groups in the presence of allylic groups. The performed gram–scale reactions and one–pot functionalizations highlighted the high applicability of the designed procedures. Based on NMR studies, we presented the possible mechanism of activation and reaction.

The third article in the series (**P3**) describes two new methods for the functionalization of allenes by hydrosilylation and hydroboration reactions using pincer cobalt complexes. These methodologies enable the selective synthesis of *E*–alkenylsilanes or *Z*–allylboranes, introducing a new approach to the hydroelementation of allenes using low–cost 3d metal complexes, without the need for the addition of activators. Two further functionalizations of the obtained products were performed, resulting in interesting building blocks for use in the synthesis of complex molecules. The NMR experiments allowed us to propose the mechanism of activation and reaction.

The fourth paper in the series (**P4**) focuses on the use of pincer cobalt complexes in the reduction of aldehydes to alcohols via hydroboration with pinacolborane. The paper demonstrates the possibility of reducing a large group of aldehydes, both aromatic and aliphatic while exhibiting a high tolerance of the process to the functional groups of the substrates. In addition, the selectivity of the procedure in the reduction of formyl groups in the presence of other substituents having a carbonyl moiety was demonstrated. A possible reaction mechanism was proposed.