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Streszczenie w języku angielskim

„Application of cobalt complexes as efficient catalysts in the coupling reactions of organosilicon compounds”

The aim of the doctoral dissertation titled *„Application of cobalt complexes as efficient catalysts in the coupling reactions of organosilicon compounds”* was to develop new, selective and efficient methods for the synthesis of organosilicon compounds – in particular siloxanes, alkoxysilanes and silazanes – based on dehydrogenative coupling reactions catalyzed by cobalt complexes. The main assumption of the work was to use inexpensive, non-toxic and easily available cobalt coordination compounds as an alternative to traditional catalysts containing noble metals.

Based on the analysis of the literature, a hypothesis was formulated that the appropriate selection of cobalt complexes and reaction conditions would make it possible to obtain the desired coupling products while limiting the formation of by-products. During the research, two classes of cobalt complexes were developed and thoroughly studied – pincer PNP systems based on a triazine backbone and complexes based on salen-type ligands. Both groups showed high catalytic activity and selectivity in coupling processes, enabling the efficient synthesis of a wide range of organosilicon compounds under mild, environmentally friendly reaction conditions consistent with the principles of green chemistry.

The dissertation includes a series of four scientific publications (**P1**–**P4**). The first of them (**P1**) concerns the catalytic coupling of alcohols with hydrosilanes, leading to the formation of silyl ethers in the presence of cobalt pincer complexes. The developed system enabled the functionalization of a wide range of aliphatic and aromatic substrates, with high selectivity and without the need for external activators. The second publication (**P2**) describes a series of reactions between various hydrosilanes and silanols, which allow controlled formation of Si–O–Si bonds (including complex structures containing silsesquioxanes) with high process efficiency. The third work (**P3**) focuses on the transformation of suitable silanes into silazanes (aminosilanes) through reactions with amines, carried out without additional activators for the precatalysts

used. As a result, it was shown that cobalt pincer catalysts exhibit high selectivity toward the formation of mono- and/or disilazanes. The fourth publication (**P4**) presents the use of salen-type cobalt complexes as efficient catalysts in coupling reactions of silanes with alcohols, silanols and amines, which made it possible to develop a universal catalytic platform for obtaining compounds containing Si–O and Si–N bonds within one reaction system.

The obtained results confirmed the high activity, selectivity and catalytic stability of the applied cobalt coordination compounds, which significantly increases the application potential of the proposed methods. All obtained products were thoroughly characterized using NMR spectroscopy (^{1}H, ^{13}C, ^{29}Si, ^{19}F), mass spectrometry and other analytical techniques, which clearly confirmed their structure and purity.

The developed catalytic dehydrogenative coupling procedures fit perfectly into the concept of sustainable and environmentally friendly chemistry, offering a real alternative to traditional noble-metal-based systems. The research results expand the knowledge in the field of cobalt complex chemistry and provide a solid basis for the further development of green methods for the synthesis of organosilicon compounds of significant industrial and material importance.