

Michał Niewiadomski, M. Sc.

Łódź, 18.05.2018

Lodz University of Technology

Faculty of Chemistry

Institute of General and Ecological Chemistry

Supervisor: Jacek Grams, D. Sc.

Co-supervisor: Agnieszka Ruppert, D. Sc.

## **Synthesis and characterization of nickel catalysts applicable for thermocatalytic conversion of cellulose**

Lignocellulosic biomass is increasingly recognized not only as an attractive renewable source of energy, but also as a feedstock for production of a wide variety of useful chemical compounds. However its conversion usually requires the use of a catalyst, which allows achieving high selectivity for obtaining the desired products.

Therefore the aim of my PhD thesis is designing effective and thermally stable nickel catalyst supported on a metal oxide, applicable for high-temperature conversion of cellulose. Accomplishing that goal was mainly dependent on the selection of optimal monoxide support (which turned out to be zirconium oxide), optimization of its synthesis method and modification with the use of cerium oxide.

The literature part presents information regarding the role of renewable sources of energy and hydrogen, biomass, the methods of its processing and the role of catalytic support. Also, examples of the application of heterogeneous catalysts in the high-temperature conversion of biomass were demonstrated.

The experimental part covered methods of catalysts' preparation, optimization of the synthesis of zirconium oxide and its modification with the use of cerium oxide. Furthermore, experimental methods were described. Investigations were performed with the incorporation of the following analytical techniques: temperature-programmed reduction (TPR), X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), transmission electron microscopy (TEM), scanning electron microscopy, X-ray photoelectron spectroscopy, time-of-flight secondary ion mass spectrometry (ToF-SIMS).