Synthesis of nickel/amine acid-complexes for their use in the homogeneous catalyzed polymerization of ethylene

Abstract

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With an annual production in excess of 100 million metric tons worldwide macromolecular molecules, the polymers, rank among the most important end-products of organic-technical chemistry. Despite great successes with early transition metals in the polymerization catalysis the development of transition-metal-complexes functioning as catalysts for the homogeneous olefin polymerization developed is not yet completed.

The main focus of this work is the development and design of new, active, ionic and neutral transition metal complexes with nickel as central metal and Amino acid(derivatives) as ligand. This set up has several advantages in comparison to reactions using early transition metals. First of all a higher stability can be ensured in polar media due to the smaller oxophilicity of the nickel metal. A second advantage is that by using amino acids as a ligand a cheap, not toxic as well as easy accessible, chiral ligand can be utilised.

The use of these complexes in the homogeneous medium-pressure polymerization of α-Olefinen represented another interesting challenge. Due to the homogeneous reaction process the polymerization yield generally is to be improved, since the catalyst is molecularly distributed in the reaction solution and therefore possesses a larger active surface which is needed for the polymerization of Ethen. Due to the homogeneous reaction process further advantages, like easy heat dissipation and mild reaction conditions, can be obtained.

The polymerization of ethylene and the dimerization of propylene were examined, by varying and optimizing different reaction parameters such as temperature, pressure and the co-catalyst concentration The manufactured polyethylene and 1-hexen are characterized with the help of different analytical methods (DSC, SEC, GC). The variation of the reaction parameters allow us to draw conclusions on their influence on the catalyst activity, the catalyst selectivity and their influence on the polymer structure.

Finally the nickel complexes are used in the so-called *nanocompound polymerization* of ethylene on silicon nano-particles. The nickel catalyst is immobilized on the surface of such a particle. A compound is to be formed, which contains the silicon nano-particles, which acts as the polymer filler, and a coating which contains the polymer. These active nano-particles were used and examined in the polymerization of ethylene.