Applications of olefin metathesis in industrial context. Immobilization, multibatch processes, recycling.

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Olefin metathesis a very powerful transformation in organic chemistry which allows for creation of C-C double bonds. Its importance was underlined by awarding the Noble Prize to Y. Chauvin, R. H. Grubbs and R.R. Schrock in 2005.

Despite many great achievements, effective removal of the metal impurities and purification of the metathesis reaction products on an industrial scale is still a major problem in metathesis reaction. Main challenges are related to: expected scale of the metathesis processes; E-factor; and expected total cost of the process. Liveliness of the catalyst and side reactions caused by catalyst decomposition products are another aspect that has to be considered. Selected method of purification of the metathesis reaction together with implementation in industrial processes have been reviewed in Chapter 1.2 of the Thesis.

Nanofiltration is one of the membrane separation processes, which have found numerous industrial applications. Recently, nanofiltration has become popular in purification of organic solvent mixtures. Recent implementations in homogeneous catalysis and especially in metathesis reaction have been described in Chapter 1.3 of the Thesis.

The main goal of my research described in the for of a PhD Thesis was to developed ruthenium complexes which will be easily removable from the reaction mixture by nanofiltration. An equally important issue to study was the optimization of the nanofiltration procedure, which means choosing of the appropriate solvent, membrane and pressure.

Molecular weight enlargement (MWE) is an attractive method of heterogeneous catalyst recycling which has been adopted in homogeneous catalysis. Of many MWE units known in the literature, POSS gained my attention because of its universality. Herein I present the synthesis of the ruthenium complexes decorated with POSS unit. Such a modification not only increased retention of the catalyst during nanofiltration but, which was the most surprising, also increased activity of the examined catalysts.