Abstract

In this dissertation thesis, new ethynylated (i) achiral and chiral bidentate and tetradentate ligands of the Schiff base-type and (ii) organometallic complexes in which these ligands coordinated Cu^{2+} ions were prepared as precursors of porous polymer networks. Individual complexes differed in size, shape or chiral character. Organometallic complexes were characterized in detail, including characterization by polarimetry and UV/Vis and CD spectroscopy in the case of chiral complexes. Selected complexes were studied by single crystal X-ray diffraction combined with advanced NMR techniques allowing the characterization of these complexes despite their paramagnetic nature.

The prepared ligands and organometallic complexes were used for the construction of a series of micro/mesoporous organometallic polyacetylene networks, while the main synthetic tool was the chain-growth coordination polymerization of the ethynyl groups of these building blocks. The networks were prepared either by direct (co)polymerization of complexes containing Cu^{2+} ions or by post-polymerization metalation of primary non-metalated networks by Cu^{2+} ions. Organometallic polyacetylene networks with high contents of Cu^{2+} ions (up to 13 wt.%) and high specific surface areas (up to 709 m^2/g) were synthesized by these methods. The prepared organometallic networks applied as heterogeneous catalysts were effective in the oxidation of linalool (substrate conversion up to 48 %) and styrene (substrate conversion up to 91 %). The catalytic activity of these networks was compared with the catalytic activity of the respective monomeric complexes. The results showed a positive effect of the incorporation of catalytically active organometallic centers into the structure of polymer networks, manifested mainly by the enhanced selectivity to the desired products.

Using a combination of chain-growth coordination polymerization and HIPE templating technique, non-metalated polyacetylene networks functionalized with -OH, $-NH_2$ and -HC=N- groups were prepared. The networks exhibited a hierarchical (micro/meso/macroporous) texture with specific surface areas up to 1 055 m^2/g and were successfully tested as adsorptive-photocatalytic materials for removing bisphenol A from water. In some cases, using a combination of adsorption and photoinitiated degradation, it was possible to remove bisphenol A with almost 100% efficiency.