7. Conclusions and outlook

A set of questions of current interest in macromolecular chemistry was tackled and resolved in this thesis. The research project included both polymer synthesis and advanced characterization of produced polymeric materials using various experimental techniques.
Particular interest was paid to block copolymers including diblock ionomers, "block-random" copolymers and block copolymers with non-linear architecture such as comb-like copolymers and molecular brushes. The main results achieved in the present thesis are (1) structure-property relationship in diblock ionomers (2) understanding the microphase separation process in A-*b*-(A-*co*-B) block copolymers and the effect of polydispersity on microdomain size (3) development of original methods for synthesis of amphiphilic block copolymers with comb-like architecture (4) the effect of side chain length on the morphological transitions in comb-like copolymers in dilute solutions.

Several future directions in research can be envisaged based on the results obtained in the present thesis. Elegant work can be done on microphase separation of polydisperse block copolymers, namely an effort to establish a new phase diagram taking into account morphological transitions and changes of size of microphase separated domains. Size is crucial in nanotechnology (optoelectronics) and polydispersity appears as an excellent tool for tuning the microdomain spacing in soft matter.
Click chemistry used in this work for modification of acrylonitrile-containing block copolymers yielded polymers with biologically active 5-vinyltetrazole groups. Nanoparticles made from such block copolymers via interfacial deposition technique were found to respond to changes in pH. The investigation is currently under way to elucidate this effect in more detail. In case of graft copolymers and loosely grafted cylindrical molecular brushes more work is required to get answer on the effect of grafting density on the conformation in solution. It will be interesting to study responsivness of synthesized graft copolymers containing weak poly(methacrylic acid) and MPEG side chains with regard to pH, salt concentration and temparature. Thermal transition effect in loosely grafted molecular brushes can be used for the separation of proteins.