Abstract

The present diploma thesis deals with the study of the thermal and the dielectric behavior of dilute solutions of the thermoresponsive brush copolymers with either poly(propylene oxide − random- ethylene oxide) or poly(propylene oxide − block-ethylene oxide) side chains. The aim of the study was the investigation of the thermoresponsive behavior and the effect of the polymer architecture for the materials with random side chains, gPrE1 and gPrE2, as well as the effect of chemical composition, for the materials with the same PO/EO ratio, gPrE1 ang gPE2. For this purpose, three dilute solutions for each one of the brush copolymers gPrE1, gPrE2 and gPE2 were prepared with 50%, 70% and 90% water content.

For the thermal study, conventional differential scanning calorimetry measurements were performed. Through the analysis of the thermograms, the dependence of the thermoresponsive temperature on the water content was determined. In particular, the transition temperature decreases with increasing water content. For gPrE1, the transition occurs in lower temperatures in comparison with the other two samples and is of better quality. In addition, the glass transition was also investigated, and two glass transitions were detected for gPrE1 55%wt, the material with the lowest T_{ph}, indicating a possible connection between the glass transition and the thermoresponsive transition. No significant differences among the samples were observed regarding the crystallization and the melting of the water, indicating that there is probably no connection with the thermoresponsive transition.

For the dielectric study, dielectric relaxation sperctroscopy measurements were performed. Due to inefficiency of the capacitor, the measurement of ε' and ε'' was not possible for high frequency in high temperature range. As a result, the study of the thermoresponsive transition was not feasible with this technique. However, water dynamics and glass transition were investigated. For every sample, two dielectric relaxations are observed in low temperatures. These relaxations are attributed to non crystalline water kinetics (relaxation I) and ice kinetics (relaxation II) and are affected by water content. Dielectric relaxation II is also affected by glass transition, since the slope in the Arrhenius diagram, thus E_{act}, changes at T_g. Finally, relaxation III, is observed after T_g, and it is attributed to kinetics of the polymer chains.