SORPTION EQUILIBRIUM OF LIQUIDS IN POLYOLEFINS

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The knowledge of phase behaviour in the reaction mixture during the olefin catalytic polymerization is essential when examining, designing and operating this polymerization process. Moreover, the reaction kinetics is determined by thermodynamics fundamentals. Transport of monomer molecules to active catalyst sites through the liquid and nascent polymer domains in the case of heterogeneous polymerization affects the polymerization rate and copolymer composition. This transport is influenced by the swelling of polymer particle, by the corresponding prolongation of the diffusion path for the monomer, and by the morphology of the nascent polymer.

We present new methodology of sorption experiments, where the solubility of liquid penetrant (e.g., n-hexane) in polyethylene is measured. Sorption experiments were carried out with several PE samples with densities of 900 to 967 kg/m^3 at different temperatures (25 to 70 °C). Thus the dependence of liquid penetrant solubility in PE on the sample density and temperature was determined.

Next part of this contribution focuses on swelling experiments in a liquid penetrant. For this purpose, a modified video-microscopic method was used [1]. Several PE samples of different densities were swelled by liquid penetrant and we determined the dependence of swelling on PE density in the temperature range from 25 to 70°C. The swelling is affected by a different content of amorphous and crystalline phase.

Besides the experiments carried out in the liquid phase, this work presents also a new methodology and preliminary results of swelling in a three-phase system polymer-liquid-gas, which is a unique experiment not previously published in the literature.

The experimental data and observed trends presented in this work contribute to the complete quantitative understanding of mass transport and sorption equilibrium of penetrants in polymers [2].

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[1] Podivinská M., Jindrová K., Chmelař J., Kosek J.: *J.Appl.Polym.Sci.* **2017**, 45035, 1-7.

[2] Chmelař J., Pokorný R., Schneider P., Smolná K., Bělský P., Kosek J.: *Polymer* **2015**, 58, 189-198.