

High Pressure Phase Behavior of Binary Systems of Carbon Dioxide and Propane with Hyperbranched Polymers

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Hyperbranched polymers are a relatively new class of polymers that can be easily synthesized via one-step reactions and represent economically promising products for large-scale industrial applications. The properties of hyperbranched polymers can be adjusted by controlled functionalization of the end groups. In this way selective solvents can be tailored that can be an alternative for ionic liquids in some applications. Seiler et al. [1] have shown the applicability of hyperbranched polymers as new selective solvents for extractive distillation and solvent extraction.

Not much information is available on the phase behaviour of systems with hyperbranched polymers. In this contribution the results are presented of an experimental investigation on the phase behaviour of carbon dioxide-boltorn H3200 and propane-boltorn H3200. Boltorn H3200 ($M_w = 10500$ g/mol, $M_w/M_n = 1.6$) is an aliphatic hyperbranched polyester (Perstorp, Sweden) with a melting point of 333 K.

In the system CO_2 -boltorn fluid phase equilibria were measured at pressures up to 400 MPa. The system probably belongs to type III of fluid phase behaviour with a metastable liquid-liquid phase split. The critical curve shows a temperature minimum and at temperatures above that temperature minimum two separate two-phase fluid-fluid regions are found. The low-pressure two-phase region shows an upper critical solution pressure, the high-pressure two-phase region shows a lower critical solution pressure. The melting curve of boltorn H3200 under carbon dioxide pressure is also measured.

The system propane-boltorn shows type III fluid phase behaviour with a stable liquid-liquid phase split. For this system besides two-phase fluid phase equilibria, a three phase curve liquid-liquid-vapour, a three-phase curve solid polymer-liquid-liquid and a three-phase curve solid polymer-liquid-vapour were also measured.

[1] Seiler et al. *Separation and Purification Technology*, **30**, 179-197 (2003).