Simple Equipment for Measurement of Total Pressure Tested on Poly(ethylene glycol) + Water System.

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Simple equipment for measurement of total pressure tested on poly(ethylene glycol) + water system

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This study belongs to a series of continuing studies of vapour–liquid equilibria (VLE) in diluted polymer + solvent systems. We investigated polystyrene + butan-2-one [1] or + toluene [2], poly(methyl methacrylate) + acetone [3] or + butan-2-one [4], poly(acrylic acid) + water [3], including earlier measurements of VLE in solutions of co- and terpolymers of octadecyl acrylate and octadecyl methacrylate with styrene and 1-vinyl-2-pyrrolidone [5–6]. All those experiments have been carried out by ebulliometric method, which prevents from use of more concentrated mixtures.

In this work, new equipment designed for total pressure determination in mixtures where one of component is not volatile, such as polymer + solvent systems, is presented. It enables measurement of pressure above solutions in a wider concentration range. The equipment has been tested and calibrated using vapour pressure of pure water. It consist of thermostat with temperature measurement (AΣΛ, model F250), 100 ml vessel for solution with magnetic stirrer with a very strong driver, and of heated manifold for charging, degassing and for pressure measurement. Pressure is measured with use of absolute heated capacitance unit MKS Baratron (pressure range 1000 Torr = 133 kPa). Mixtures were prepared by weighing to obtain volume of 50 ml, approx.

New experimental data on VLE in the poly(ethylene glycol) [PEG, M_n = 6000 g/mol] + water were determined under isothermal conditions at 308.15 and 313.15 K. It can be seen that it was possible to cover concentration region up to 50 wt. % of solvent.

The experimental data were correlated using the UNIQUAC-FV model [7]. In order to compare our data with other available sources, we correlated all published data for the PEG + water system determined by different methods [8–10] using the same model. In addition, we predicted the activities of water in mixtures with PEG using the Entropic-FV model [11].

It can be concluded that the set-up enables to determine vapour pressure data of mixtures with higher amount of polymer in comparison with the ebulliometric method, which provides the data at lower concentrations only due to problems with smooth boiling, usually occurring above 15 % of polymer. The pressure measurement unit must be calibrated for application at higher temperatures (up to 450 K). Another unit of MKS Baratron (with pressure range 10 Torr = 1.33 kPa), heatable to 500 K will be used later on as zero indicator. Data for the PEG + water system were successfully correlated using the UNIQUAC-FV model and they complete published data sets. The Entropic-FV model was tested against the obtained experimental data and can be used to predict VLE in the studied system.

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