Concentration of a supercritical gas absorbed in a polymer and the concomitant change in volume of the polymer

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Polymer materials are widely used in different applications where the knowledge and the control of their transport properties are required. For example, in food and pharmaceutical packaging, drug delivery, petroleum production and refining activities, sorption (solubility, permeability) of gases through polymers must be documented.

The present contribution deals with the correlation of selected data obtained simultaneously experimentally namely: the concentration of a supercritical gas in a polymer, and of the concomitant change in volume of the polymer, along different isotherms as a function of pressure. The experimental set-up, VW-pVT technique [1] consists in an original coupling of two techniques, a vibrating-wire sensor VW and a pressure decay pVT-method.

This is illustrated with the sorption and desorption of CO_2 in semicrystalline polymers like polyethylene, MDPE, and fluorinated polymers, PVDF, over the temperature range from ambient to 391 K and at pressures up to 45 MPa.

Experiments allow to establish the apparent concentration of gas dissolved in the polymer ; the concomitant dilatation of the polymer is evaluated using the Sanchez-Lacombe equation of state. Then, the semi-empirical "dual-mode" model is used to correlate and interpret the observed (corrected) concentration of the gas in the polymer. Our results are in good agreement with few existing literature data.

Refe rences

[1] Hilic, S. ; Boyer, S.A.E. ; Pádua, A.A.H. and Grolier, J-P.E. *J. Polym. Sci. B*: Polym. Phys., 39, 2063-2070 (2001)

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