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Diffusion of gaseous and supercritical CO_2 through polycarbonate[1] MICHAEL GOODMAN, RAHMI OZISIK, Rensselaer Polytechnic Institute — The design of polymeric materials for applications such as separation membranes and nanostructured foams requires prediction of gas transport properties under a wide range of pressures. In the current study, transport of CO_2 both in gaseous and supercritical state through samples of polycarbonate at 51 °C and pressures from 15 to 2000 psi was measured using an asymptotic time lag apparatus. Through volumetric calibration, the traditional analysis was extended to yield permeability (P) and solubility (S), in addition to the usual asymptotic diffusivity (D_a). Nonlinear least squares fitting to a truncated series solution then provided an alternative measurement of the (transient) diffusivity (D_t), as well as the surface concentration (C_o) of adsorbed gas. At 1 atm, D_a and D_t were within a factor of 2 from selected handbook values; and with increasing pressure, both exhibited an overall downward trend, consistent with other studies, but an unexpected dropoff occurred between 1350 and 1500 psi. As expected, C_o showed an overall increase with pressure, but as with P and S, displayed a peculiar drop between 1350 and 1500 psi. Measurement of C_o in polycarbonate has never been done before and constitutes a novel feature of this study.

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