

AN ABSTRACT OF A THESIS

ESTIMATION OF EFFECTIVE DIFFUSIVITY OF GASES IN PLASTIC FOAMS BY A GRAVIMETRIC METHOD

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Master of Science in Chemical Engineering

Computer programs have been modified to record the weight of foam specimens from a mettler AT261 balance along with pressure and temperature readings. The weight readings were accounted for atmospheric pressure variations by ideal gas law and were recorded at constant temperature with a temperature variation of ± 0.2 °C. The measured weight readings were used to calculate the effective diffusion coefficients. Experiments were performed on the desorption of CO₂, O₂, and N₂ at 40, 25, and 5°C in thin PUIR foam samples having an average density of 32.2 kg/cu m and thickness ranging from 1.5 to 2.5 mm. The effective diffusion coefficients at 25 °C were 2.99E-06 cm²/sec for CO₂, 3.32E-07 cm²/sec for O₂ and 3.14E-08 cm²/sec for N₂. Based on these measurements, the ratio of Arrhenius activation energy to the gas constant has been determined and the values were 3148.8 K for CO₂, 2586 K for O₂, and 2782.6 K for N₂, respectively. During the course of the desorption of a gas such as CO₂, O₂, or N₂, the absolute humidity inside the desorption chamber was maintained constant by supplying chilled air at around 5°C into the chamber. Though the absolute humidity was maintained constant, the variations in relative humidity had a profoundly undesirable effect on the measured effective diffusion coefficients at 5 °C. It is recommended that a relative humidity control loop be attached to the measurement enclosure and that future measurements should be performed at constant relative humidity.

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CERTIFICATE OF APPROVAL OF THESIS

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