THERMAL CONDUCTIVITY OF DENSE GAS MIXTURES

by

E.W. COMINGS - GILMORE (NEWARK DELAWARE U.S.A.)

The secondary high pressure thermal conductivity cell of Comings and Kramer was modified to improve the reproducibility of the measurements and to decrease the time required to make the measurements. Using carbon dioxide at pressures from 1 to 3000 atm. to calibrate the cell, the thermal conductivity of the pure gases nitrogen and ethane and approximately 20, 40, 60, and 80 % binary mixtures of carbon dioxide-nitrogen and carbon dioxide-ethane were determined at 75° C to 3000 atm. Using argon from 1 to 2500 atm. to calibrate the cell, the thermal conductivity of ethane and approximately 20, 40, 60, and 80 % mixtures of ethane and nitrogen were determined up to 1000 atm. at 75° C. Higher pressures are not being reported in this case because the conductivities are out of the range of the conductivity of the calibrating gas.

An attempt was made to use the Enskog dense gas mixture equation with a correction for internal degrees of freedom using data obtained from pure gases. However, the equation predicted mixture conductivities in error by as much as 75 % at the highest densities. Strong deviations from linearity near the critical density were explained in terms of cluster theory. The Lindsay-Bromley relation, wich was derived for dilute gases

.

COMI EW65 0127

65-01

MALA 1860

and requires viscosity data at the pressure in question was found to give better results, with a maximum deviation of 30 %, in the region of the critical density and a close fit at the highest pressures. However, the best correlation was obtained with a simple reciprocal relationship which required a knowledge of only the mole fraction and the conductivity at the temperature and pressure in question. This relationship gave a maximum deviation of 25 % and an excellent fit at the highest densities.

- 2 -

20 . 1

White we are a second to white the second of the second of the second second second second second second second