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Discussion

F. G. Keyes.[5] The values of viscosity of hydrogen, helium, nitrogen, argon, and air at 25 C and to 70 atm, reported in 1954 by Kestin and Pilarczyk using the oscillating-disk viscometer, respond quite satisfactorily to the application of the theory advanced in this paper. The agreement of the revised values at 1 atm with similar values, most of which were obtained with the capillary-flow method, is all that could be desired.

The pressure effect in the case of argon is uniformly 0.6 per cent greater than the results reported by Michels, Botzen, and Schuurman in 1954 (24). It scarcely appears reasonable that a small difference in purity of $^1/_5$ per cent would account for a uniform viscosity difference independent of pressure, equal to 0.53 per cent. Were the impurity nitrogen in the authors' argon and the argon of reference (24) 100 per cent in purity, the viscosity of the 99.8 per cent argon of the authors is estimated to be at most three of the 10^{-7} poise units lower. It is significant perhaps that the one atmosphere value, namely 2250, of reference (24) is lower than the mean of the seven cited values; i.e., 2261. The authors' suggestion that M/M_∞ may not be independent of the nature of the gas, particularly as heavy a gas as argon, should be explored possibly by employing xenon, the heaviest of the rare gases.

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Authors' Closure

The authors appreciate Professor Keyes's remarks and interest. His suggestions will be taken up in future work and reported in due course. In a private communication Professor Keyes expressed interest in a correlation of the results given in the paper on the basis of density, having found that the variation of the difference $\mu - \mu_a$ is a function of density alone. Our data correlate as follows

$$10^5(\mu - \mu_a) = 2(10^{2.839\rho} - 1) \qquad \text{for nitrogen}^6$$

$$10^5(\mu - \mu_a) = 2(10^{2.706\rho} - 1) \qquad \text{for air}$$

$$10^5(\mu - \mu_a) = 1.5(10^{3.111\rho} - 1) \qquad \text{for argon}$$

$$10^7(\mu - \mu_a) = 2(10^{87.45\rho} - 1) \qquad \text{for helium}$$

$$10^7(\mu - \mu_a) = 2(10^{173.2\rho} - 1) \qquad \text{for hydrogen}$$

The equations obviously imply that the atmospheric value μ_a is identical with that for the limit of zero density.

[6] Calculated by Professor Keyes on the basis of the data of the paper. The authors wish to acknowledge Professor Keyes's help in this matter.

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