

FIG. 1. Relative viscosity at 30° of *n*-hexane carbon disulphide against concentration.

slipping over each other. Raman and Krishnan⁷ from their studies on birefringence have considered that there is a tendency for nonspherical molecules to orientate under mechanical stress within a liquid; moreover, such an arrangement is most probable for a statistical energy distribution.

Increase of pressure at constant temperature could not be expected to cause any irregularity in the orientation; rather, it should increase the uniformity of it. Bridgman's⁸ comment on this point is applicable to the present results: "Along with the idea of molecules with shape goes the conception that at high pressures these shapes must be forced more or less to adapt themselves to each other; in other words, the molecules must begin to show traces of regular arrangement. The regularity is by no means the thorough-going regularity of a crystal in which the molecules are permanently moored to certain mean positions, the molecules of the liquid still circulate about among each other, but as they slide past each other there may be a growing tendency at higher pressures to point the long axes in the direction of relative motion, for example. This increasing order of arrangement seems not only natural, but inevitable at high pressures." Increase of temperature would tend to break up the parallel orientation by increasing the thermal agitation.

⁷ C. V. Raman and K. S. Krishnan, *Phil. Mag.* **5**, 767 (1928).

⁸ P. W. Bridgman, *Proc. Am. Acad.* **42**, 111 (1913).

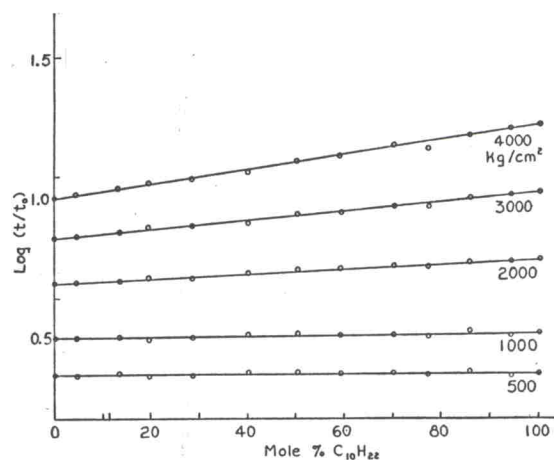


FIG. 2. Relative viscosity at 30° of *n*-hexane *n*-decane against concentration.

Under these conditions, the interlocking of molecules probably takes place in a simple way.

There have been several equations proposed for the viscosity of binary mixtures of chemically indifferent liquids

$$\eta = \eta_1^x \eta_2^{(1-x)}, \text{ Arrhenius.}^9 \quad (1)$$

$$\eta = \eta_1 x + \eta_2 (1-x), \text{ Kendall and Monroe.}^{10} \quad (2)$$

$$\varphi = \varphi_1 x + \varphi_2 (1-x), \text{ Bingham.}^{11} \quad (3)$$

$$\eta = \eta_1 + (\eta_2 - \eta_1) K_2 a_2 Z_m / K_1 a_1 (1 - Z_m) + K_2 a_2 Z_m, \text{ Ishikawa.}^{12} \quad (4)$$

$$\varphi = \varphi_1 a + \varphi_2 b - K(a-m)(v_1 - v_2), \text{ Bingham and Brown.}^{13} \quad (5)$$

$$\log \eta = m \cdot \log \eta_1 + (1-m) \log \eta_2 - \int (q_m / R \cdot T^2) dT, \text{ Lederer.}^{14} \quad (6)$$

$$L_m = xL_a + (1-x)L_b$$

$$L_m' = xL_1' + (1-x)L_2' + Cx(1-x), \text{ Cragoe.}^{15} \quad (7)$$

In these formulae, η is the viscosity of the mixture, φ the fluidity, $\eta_1, \eta_2, \varphi_1, \varphi_2$, the viscosities and fluidities, respectively, of the components. It has been usual to consider x as the volume,

⁹ S. Arrhenius, *Zeits. f. physik. Chemie* **1**, 285 (1887).

¹⁰ J. Kendall and K. P. Monroe, *J. Am. Chem. Soc.* **39**, 1802 (1917).

¹¹ E. C. Bingham, *J. Am. Chem. Soc.* **35**, 195 (1906).

¹² T. Ishikawa, *Bull. Chem. Soc. Jap.* **4**, 5 (1929).

¹³ E. C. Bingham and D. F. Brown, *J. Rheology* **3**, 95 (1932).

¹⁴ E. L. Lederer, *Kolloid-Bei.* **34-35**, 270 (1932).

¹⁵ C. S. Cragoe, *Proc. World Petroleum Congress, London* **F**, 529 (1933).



FIG. 3. Rel

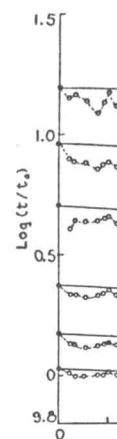


FIG. 4. Rela

weight a
For an ex
Eqs. (4)
original p
The two
carbon di
Arrhenius
these case
icients of y
in mixtur
concentra
change, fo