

indicate an apparent discontinuity in the frequency characteristic. A change in the mean current/gap voltage relationship, resulting in an increase in the charge per burst, is also evident.

A likely explanation of the phenomenon, which has so far gained considerable experimental support, is to be found in an extension of Loeb's³ theory on the mechanism of Trichel pulses; that is to say, the new mode is engendered by space-charge considerations, as distinct from changes in Townsend's second coefficient, γ , for example.

A fuller report and discussion on the subject will be published in the near future.

ALLAN GREENWOOD

Department of Electrical Engineering,
University, Leeds 2.

¹ Trichel, G. W., *Phys. Rev.*, **54**, 1078 (1938).

² Loeb, L. B., and Kipp, A. F., *J. App. Phys.*, **10**, 142 (1939).

³ Loeb, L. B., *J. App. Phys.*, **19**, 882 (1948).

A Relationship between Heat Conductivity and Viscosity of Liquids

ANDRADE¹ developed a theory of viscosity of liquids based on a model in which the molecules are regarded as executing vibrations essentially similar to those characteristic of the solid state, the chief difference between the solid and the liquid states being that in the latter the amplitudes of the vibrations are so large that molecules make collisions (resulting in 'temporary unions') with neighbours at every extreme displacement. His viscosity equation is

$$\eta = \frac{4}{3} \cdot \frac{m\nu}{\sigma}, \quad (1)$$

where η is the viscosity of the liquid, m the mass of a molecule in the liquid, ν its vibration frequency, and σ the average distance between the centres of the molecules.

From an essentially similar model, Osida² deduced that

$$K = \frac{4k\nu}{\sigma}, \quad (2)$$

where K is the heat conductivity of the liquid and k the gas constant per molecule.

From (1) and (2),

$$mK/\eta = 3k.$$

Multiplying each side by the Avogadro number N ,

$$NmK/\eta = 3Nk,$$

or as the molecular weight $M = Nm$ and the molar gas constant $R = Nk$,

$$MK/\eta = 3R. \quad (3)$$

Since R in calories is very nearly 2,

$$MK/\eta = 6;$$

K is in calories, and η in poises.

In the accompanying table are shown values for the molecular weight in the vapour state M , the heat conductivity at the boiling point (a 'corresponding' temperature) K_{bp} in calories, the viscosity at the boiling point η_{bp} in poises and MK_{bp}/η_{bp} of some 'normal' liquids, K for which is known fairly accurately from Bridgman's measurements³. Values for K_{bp} have been calculated from Bridgman's data at 30° and 75° C., assuming a linear relationship

Liquid	M	K_{bp}	η_{bp}	MK_{bp}/η_{bp}
Acetone	58.1	0.000414	0.00232	10.4
n-Pentane	72.1	320	200	11.5
Ether	74.1	328	205	11.9
Carbon disulphide	76.1	375	308	9.26
Toluene	92.1	319	248	11.9
Ethyl bromide	109	284	329	9.41
Ethyl iodide	156	261	371	11

between K and temperature⁴. Values for η_{bp} are after Macleod⁵. It will be seen from the last column of the table that

$$MK_{bp}/\eta_{bp} = \text{constant}. \quad (4)$$

The mean value of the constant is 10.8. It is evident from this that, to be applicable at the boiling point, the numerical coefficient in equation (3) requires modification. This can be done, satisfactorily enough, only on examination of a number of liquids. Unfortunately, however, data on K are scarce. Further, different methods of measurement yield varying values. Until these difficulties are overcome, the numerical coefficient in equation (3) can be modified tentatively to 5.4.

S. R. MOHANTY

Department of Chemistry,
Banaras Hindu University.
Feb. 1.

¹ Andrade, *Phil. Mag.*, **17**, 497 (1934).

² Osida, *Proc. Phys. Math. Soc. Japan*, **21**, 353 (1939).

³ Bridgman, *Proc. Amer. Acad. Sci.*, **59**, 141 (1923-24).

⁴ Mohanty, *Curr. Sci.*, **17**, 148 (1948).

⁵ Macleod, *Trans. Farad. Soc.*, **21**, 160 (1925-26).

Elastic Constants of Galena

RECENTLY, Ramachandran and Wooster¹ have obtained the elastic constants of galena, among other substances, from measurements on diffuse reflexion of X-rays, and reported disagreement with the values given earlier by one of us². Ramachandran has also directed our attention to this in private communications. This substance, in the light of such values, also figures as an exception in a paper by Lonsdale³ dealing with the vibration amplitudes of atoms in cubic crystals. Its elastic constants have therefore been re-determined, employing the wedge method and a very much better crystal than was available at the time of the earlier investigations. Frequencies in the range 2-12 Mc./sec., and (001) and (111) sections of different thicknesses ranging from 1.450 mm. to 1.929 mm., have been used. Constants now obtained along with the bulk modulus K in units of 10^{11} dynes cm.⁻² are $c_{11} = 12.70$, $c_{12} = 2.98$, $c_{44} = 2.48$ and $K = 6.22$. They show that the Cauchy relation is fairly well satisfied. c_{44} and c_{12} do not differ very much from those of Ramachandran and Wooster, whereas c_{11} is somewhat larger. These values are to be regarded as much more reliable than any published earlier.

S. BHAGAVANTAM
T. SESHAGRI RAO

Physical Laboratories,
Osmania University,
Hyderabad 7.
Feb. 26.

¹ Ramachandran, G. N., and Wooster, W. A., *Nature*, **164**, 839 (1949).

² Bhagavantam, S., 33rd Ind. Sci. Cong., Pres. address, Section of Physics (1946).

³ Lonsdale, K., *Acta Cryst.*, **1**, 142 (1948).