X-RAY METHOD OF DETERMINING THE AMPLITUDE FACTORS OF ORGANIC LIQUIDS

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ABSTRACT. This paper is a further development of the work published in the Zeitschrift für Physik by A. K. Dutta and T. Ratho (1956). The well known relation

$$\mu t_o = 1.$$

where μ is the absorption coefficient of the liquid for the radiation used and t_o is the optimum thickness, has been found to show marked deviations from the value unity for large αt_o values where α is the amplitude factor of the liquid. Taking 0.57 as the value of α and 0.465 (Olson 1923) for the value of μ for M_oK_α radiation for the liquid xylene, the theoretical scattering curve after

$$I_{max} = \frac{CI_o}{\alpha} e^{-\mu t} \phi(\alpha t)$$

for $I_{max}-t$ is found to be in good agreement with the experimental curve where t is the thickness of the liquid column. Here I_{max} is the maximum scattered intensity in a direction corresponding to a sample of thickness t, I_o being the initial value, ϕ is the error integral (Jahnke 1945) and C is the scattering factor characteristic of the liquid. It is this α that determines the Gaussian distribution of intensity for a particular liquid. The earlier calculations (N. S. Gingrich, 1945) on the optimum thickness of liquids without taking superposition effects into consideration lead to

$$\mu t_o = 1.$$

for low values of αt_o as reportzd earlier (Dutta and Ratho, 1956). Therefore our present measurements which are in good agreement with the theoretical predictions establish fully the fact that there is a marked deviation from this relation for large αt_o values. The procedure suggests a method of calculating the amplitude factors of liquids.

THEORY AND DISCUSSION

The experimental set up is the same as reported in the paper referred to above. At present the samples of xylene had the thicknesses of 8,11,14, 16, 18 and 20 mms. The experimental curve is shown in Fig. 1.

The maximum intensity I_{max} due to the scattered X-rays is represented by the formula

$$I_{max} = \frac{CI_0}{\alpha} e^{-\mu t}\phi(\alpha t)$$

Fig. 1 shows the theoretical values of I_{max} for the corresponding values of t. On reducing the theoretical values by a suitable factor 0.2379 this curve is made to superpose on the experimental curve with good agreement, Fig. 2.

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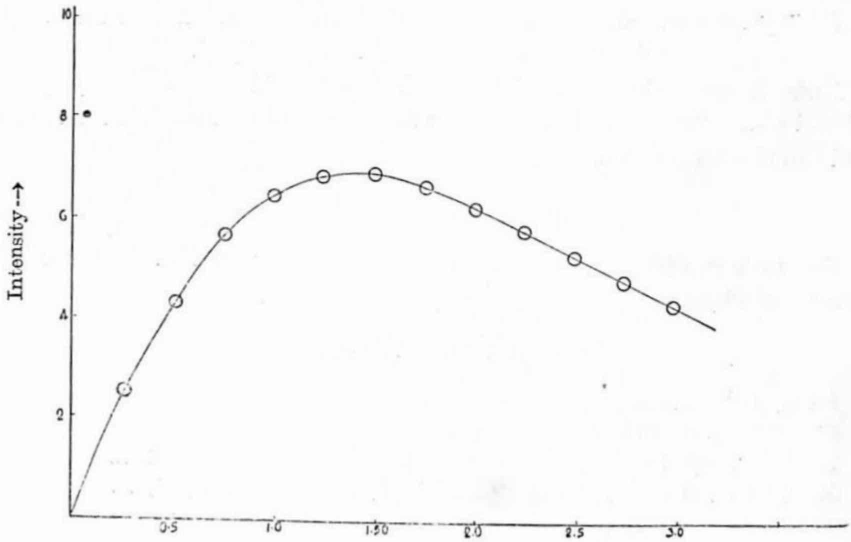

Fig. 1
Thickness (cms) →

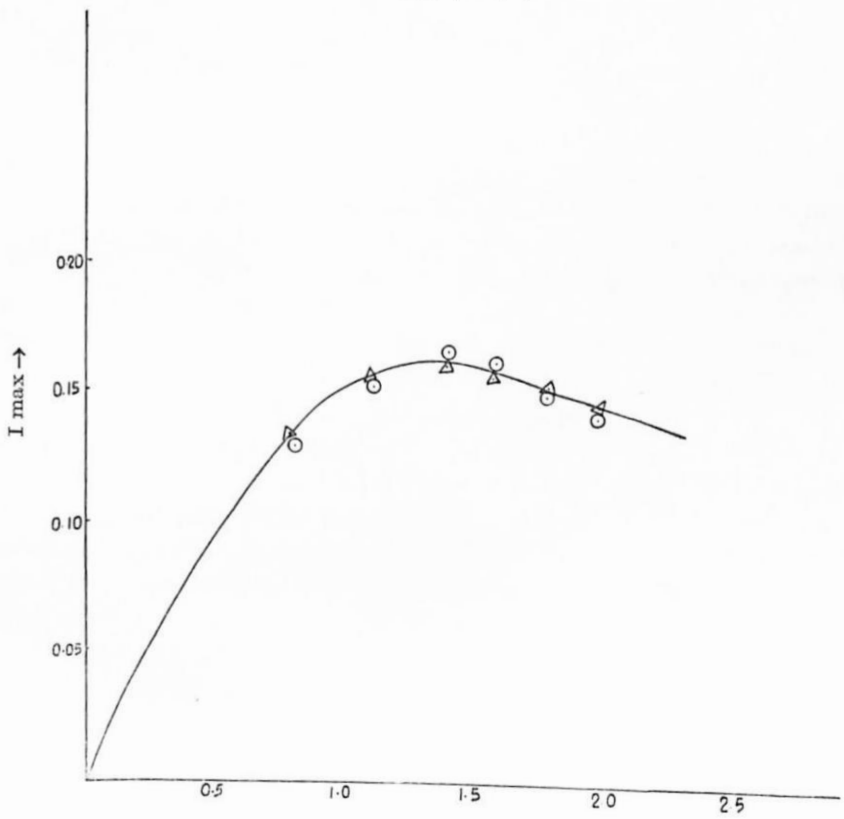

Fig. 2.
Thickness (cms)→ ⊙ Experimental
Δ Theoretical

Taking different values of α that value, the theoretical curve of which agrees with the experimental curve, can be assigned to the liquid. A relation of the amplitude factor with compressibility and other liquid constants may possibly be found out. The variation of amplitude factor with temperature for the same liquid can also be studied.

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