ULTRASONIC RELAXATION IN PHENYL SALICYLATE

Among the various relaxing organic liquids which exhibit rotational isomerism, esters\(^1\)-\(^3\) of monocarboxylic acids are of special interest because of the fact that the relaxation frequency in these substances lies in the low megacycle region which is easily accessible to the conventional pulse technique.

With a view to confirm the relaxation in esters of salicylic acids the authors have studied the ultrasonic absorption and velocity using the standard pulse technique in the frequency range of 3-21 Mc/sec and the temperature range of 50-80° C. for phenyl salicylate. The ultrasonic cell is a double-walled glass cell and the desired temperature is maintained by circulating water through the jacket from a thermostat which is capable of maintaining the temperature of the circulating water within ± 0.1° C. The velocity measurements are accurate to ± 0.5% and the absorption measurements within ± 10%. The substance is a sample from B.D.H. and is distilled before use.

The ultrasonic velocity is found to decrease linearly with temperature as is normal in organic liquids. It is found that there is an abnormal variation of \(\alpha/f^2\) with frequency where \(\alpha\) is the absorption coefficient and \(f\) is the frequency. Thus it is expected that the relaxation frequency lies within the frequency region of study.

If a single relaxation frequency \((f_r)\) is assumed the frequency variation of the absorption parameter can be represented by the equation of the form

\[
\frac{\alpha}{f^2} = B + \frac{A}{1 + (f/f_r)^2},
\]

where \(B\) is the high frequency residual absorption which is determined by giving various values to \(B\) until a plot of \((\alpha/f^2 - B)^{-1}\) versus \(f^2\) gives a straight line. From the intercept and the slope of this straight line, 'A' and the relaxation frequency '\(f_r\)' have been computed. The excess absorption per wavelength \(\mu\) has been computed using the relation

\[
\mu = \alpha\lambda = (\alpha/f^2 - B)fv,
\]

where \(v\) is the velocity of sound.

In Fig. 1 excess absorption per wavelength \(\alpha\lambda\) versus frequency is plotted for different temperatures. It can be seen that the characteristic bell-shaped curves are obtained at all temperatures in the frequency region studied.

![Figure 1](image-url)

The relaxation frequency is centred around 10 Mc/sec at 60° C. It can also be seen that the relaxation frequency which corresponds to the frequency of the peak excess absorption increases with increasing temperature. The variation of relaxation frequency is also studied with concentration in polar solvent acetone and non-polar solvent n-hexane and it is found that '\(f\)' in both the solvents is independent of concentration within experimental error. As this is characteristic of rotational isomerism this relaxation has been attributed to rotational isomerism.

We are grateful to Prof. B. R. Rao for his encouragement and to the Council of Scientific and Industrial Research for the financial assistance.

Dept. of Physics, P. CHANDRASEKHARA RAJU, Andhra University, K. SUBBA RAO. Waltair, September 9, 1970.