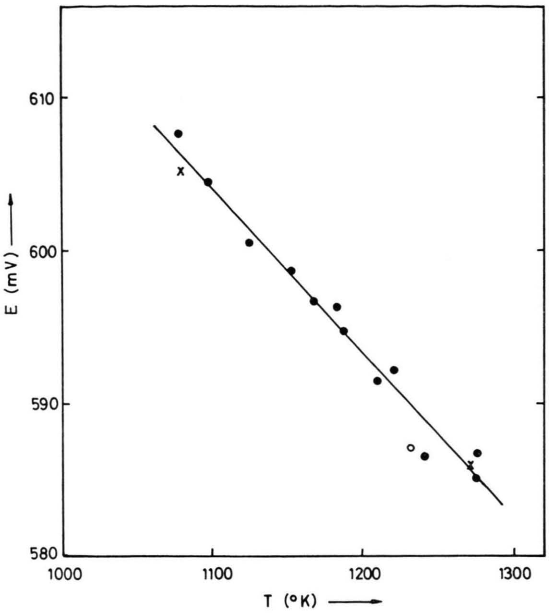

Fig. 1. Electromotive force vs. temperature of the electrochemical cell:

$$\mathrm{Pt} \mid \mathrm{Ta}+\mathrm{Ta_2O_5} \mid \mathrm{ThO_2}(+\mathrm{La_2O_3}) \mid \mathrm{Fe}+\text{“FeO”} \mid \mathrm{Pt}.$$

The recently reported JANAF data[5] have been taken into account for calculating the $\Delta G^0{}_{f,\text{“FeO”}}$ vs. T function. This function, in the range 1000 – 1300 °K, may be fairly well approximated by the linear relationship:

$$\Delta G^0{}_{f,\text{“FeO”}} = -63.25 + 15.56 \cdot 10^{-3}\, T \text{ kcal/atom of oxygen.} \qquad (3)$$

Substituting Equations (2) and (3) in Eq. (1), yields ($F = 23.06$ kcal · Volt^{-1} · equiv.$^{-1}$):

$$\frac{\Delta G^0{}_{f,\mathrm{Ta_2O_5}}}{5} = -96.62 + 20.57 \cdot 10^{-3}\, T \text{ kcal/atom of oxygen.}$$

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[5] JANAF Thermochemical Tables Addendum PB 168 370/1 (Clearinghouse 1966).

The Temperature Dependence of Far Infra-red Absorptions in Non-polar Liquids

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Recent measurements[1] of non-polar liquids in the far infra-red have confirmed the expectations of Poley[2] and Whiffen[3] by showing the presence of a distinct absorption. The possible origins of the absorption have already been discussed[4, 5]. To add some new data we have measured the temperature dependence of the infrared absorption in the range 10 – 100 cm^{-1} for three non-polar liquids: C_6H_6, CS_2 and CCl_4.

All spectra were recorded on a Fourier spectrophotometer with a RIIC variable temperature cell.

The three characteristic features of the measurements are (Figs, 1 – 3 and Table 1):

1. The ratios of the integrated absorption intensities of $C_6H_6 : CS_2 : CCl_4$ are 1 : 0.75 : 0.36.
2. There is an increase of the integrated absorption intensity with the decrease of temperature.
3. The bands shift to higher frequencies with increasing temperature.

The integrated absorption intensities depend on the moments of inertia and the observed trend suggests the rotational origin of these bands. This statement has to

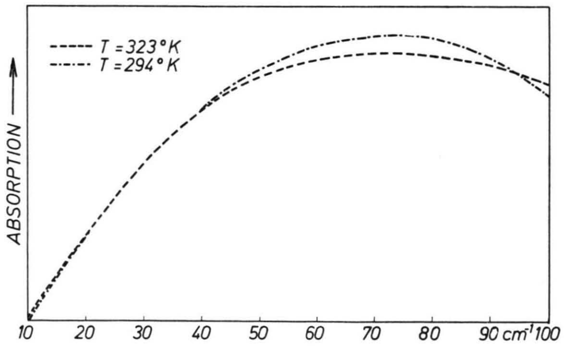

Fig. 1. The effect of the temperature on the absorption of C_6H_6.

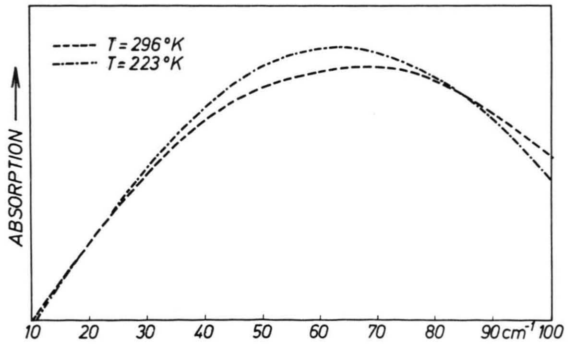

Fig. 2. The effect of the temperature on the absorption of CS_2.

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[1] S. K. Garg, J. E. Bertie, H. Klip, and C. P. Smyth, J. Chem. Phys. **49**, 2551 [1968] and references therein.

[2] J. Ph. Poley, J. Appl. Sci. B **4**, 337 [1955].

[3] D. H. Whiffen, Trans. Faraday Soc. **45**, 124 [1949].

[4] N. E. Hill, Chem. Phys. Letters **2**, 5 [1968].

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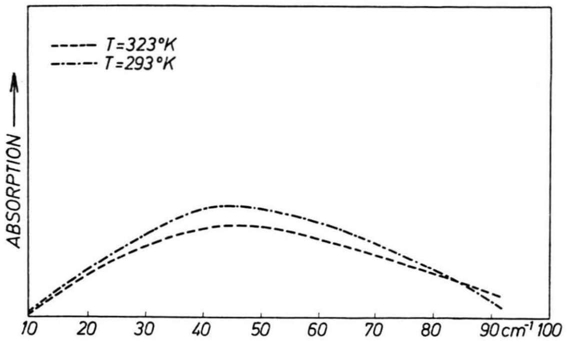

Fig. 3. The effect of the temperature on the absorption of CCl_4.

	Temperature interval (T in °C)	I.A. 1 (%)	B.S. (cm^{-1})
C_6H_6	27	4	2
CS_2	70	5	5
CCl_4	35	7	4

Table 1. The observed changes of the integrated absorption intensity (I.A. 1) and band shifts (B.S.).

be taken with caution because the moment analysis of bands may show that the calculated moments of inertia have not the same trend as the moments calculated from the geometry of the molecules.

The increase of the integrated absorption intensity with decreasing temperature is small but nevertheless only a part of this increase can be accounted for by the larger band width at higher temperature. This observation can be qualitatively explained by the assumption [6] that the absorption is not due to isolated molecules but is a result of the collective behaviour of the liquid.

The increase in half-width of the bands at higher temperatures supports the assumption that the absorption is of the resonance character. The temperature dependence of the band shift emphasizes the translational [7] character of the absorption.

The observed changes cannot be explained using the measurements in Ref. [1] with the assumption that only Debye relaxation absorption (below 10 cm^{-1}) is responsible for the observed changes.

Our measurements are consistent with the proposition [4, 5] that the absorption is of the resonance character with rotation-translation mechanism where the collective behaviour of the liquid is an important factor [6].

The authors are grateful to the Beckman-RIIC limited for making Fourier Spectrophotometer F 720 available to us.

[6] H. S. Gabelnick and H. L. Strass, J. Chem. Phys. **49**, 2334 [1968].

[7] D. R. Bosomworth and H. P. Gush, Can. J. Phys. **43**, 751 [1965].

The Effect of Carrier Concentration on Microwave Emission from n-Type Indium Antimonide

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The effect of carrier concentration on the threshold for microwave emission from InSb was determined. Threshold electric fields are lower for higher concentrations and the magnetic field dependence is reduced.

The influence of carrier concentration on the threshold values of the applied electric and magnetic fields required to stimulate microwave emission was determined by using otherwise similar samples in identical experiments. The power gain for samples of different carrier concentration was determined by comparing the percent change in applied electric field strength required to increase emission from the threshold level to an arbitrary higher level. Also the effect of diffused n^+ contacts on microwave thresholds was studied by first diffusing Sn to a depth of 30 μ and then removing this layer in stages and comparing the resulting threshold curves.

The samples used had carrier concentrations of $2 \times 10^{14}/cm^3$, $3 \times 10^{15}/cm^3$, and $1.9 \times 10^{16}/cm^3$ and mobilities of 6.5×10^5 cm^2/V-sec, 2.2×10^5 cm^2/V-sec, and 1.2×10^5 cm^2/V-sec, respectively. The InSb was cut into $.5 \times .5 \times 5.0$ mm^3 bars and then polished in CP4. Ohmic contacts were applied using Sn and a $ZnCl_2$ flux. The samples were cooled to 77 °K in liquid nitrogen. The electric field was supplied in 10 μsec pulses and the perpendicular magnetic field by a $0-6$ kG electromagnet. A heterodyne microwave receiver with a sensitivity of -95 dBm tuned to 2 GHz detected the emission which had first been passed through a high pass filter to limit spurious signals. The output of this receiver was displayed on an oscilloscope.

For the lowest carrier concentration, the threshold for emission was similar to that reported earlier [1], the required electric field increasing sharply as the magnetic field was decreased as shown in Fig. 1. Samples of the intermediate concentration behaved quite differently with the required electric field being approximately constant at 12 V/cm and emission persisting as B was reduced toward zero. For the highest concentration, the required electric field strength was only 3 V/cm.

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[1] D. K. Ferry and W. A. Porter, Microwave Emission and High Frequency Oscillations in n-Type InSb, IBM Journal **13**, 621 [1969].