LETTERS TO THE EDITOR

A METHOD FOR ESTIMATING THE ULTRASONIC VELOCITY IN SOLIDS

FROM the data obtained regarding the supersonic velocities in organic liquids, Rao[1] has suggested a simple relation

$$v^{1/3} \cdot \frac{M}{d} = R \qquad (1)$$

where v is the velocity of supersonic waves in the liquid of molecular weight M and density d. R is a constant independent of temperature. It was further observed that R is an additive function of the chemical constituents of the liquids.

In the case of liquid mixtures, this relation can be extended as follows :

$$R_{12} = v_{12}^{1/3} \cdot \frac{M_{12}}{d_{12}} \qquad (2)$$

$$R_{12} = R_1 x + (1-x)\, R_2 \qquad (3)$$

$$M_{12} = M_1 x + (1-x)\, M_2 \qquad (4)$$

where R_1 and R_2 are the values of R in the case of solute and solvent respectively and R_{12} that of the mixture. M_1 and M_2 are the molecular weights of the solute and solvent, while M_{12} is that of the solution, x being the molecular fraction of the solute, v_{12} is the velocity of supersonic waves in the mixture whose density is d_{12}. For the two constituents of the mixture, the values of R will be given by eq. (1).

The author has extended these results to the case in which the solute is a solid. Experimental results on the solutions of different concentrations of benzoic acid in ethyl alcohol, propyl alcohol, butyl alcohol and amyl alcohol are reported in a paper (Lal and Sharma[2]) and detailed results on the solutions of benzoic acid in benzene, xylene and toluene are to be reported elsewhere. It is found that Rao's equation can be extended to solid-liquid solutions and the mixture law as given by eq. (3) also holds good in the case of solid-liquid solutions.

Further, the values of the constant R for the solute (benzoic acid) have been calculated from above equations for the different concentrations of the solute and in different solvents. It is very interesting to note that these values of R are nearly the same for the same solute irrespective of the solvent. As we are getting the constant value for the solute (solid) in every case, we may extend Rao's equation

$$v^{1/3} \cdot \frac{M}{d} = R$$

to the case of solids and calculate the velocity of supersonic waves in the solute. The method is thus useful in estimating the ultrasonic velocity in a pure solid solute existing in a hypothetical liquid state at room temperature. The velocity in the case of benzoic acid comes out to be $3{\cdot}92 \times 10^5$ cm./sec. It will be quite interesting to test whether this velocity agrees with the value of the velocity in the solute in the molten and in the solid state.

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Lucknow University,
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POLARIZATION STUDIES ON CHROMATE-TREATED ZINC

MUCH basic and significant information about the processes associated with corrosion inhibition can be obtained from polarization studies.[1,2] It is shown below that polarization data are helpful in elucidating the fundamental mechanism by which chromate treatment of zinc increases the resistance of this metal to corrosion.

Analytical data have shown that a film approximately 0·00002" thick of basic chromium chromate of general formula Cr_2O_3, CrO_3, nH_2O is formed on the metal surface during Cronak process.[3] The hexavalent chromium in this film, which is slightly soluble, is leached into the corrosive medium and protection to the metal surface is believed to be obtained both by the well-known inhibiting action of hexavalent chromium in solution and by the insoluble, presumably, trivalent chromium film left on the metal surface.[4]

Fig. 1 shows polarization curves obtained shortly after immersion of untreated and chro-