analogy with Reynolds's criterion for the transition from non-turbulent to turbulent states as the flow velocity is varied is very attractive. The analogy is carried still further by the fact that, in the viscous grain-boundary system, the shapes of the transition curves for elastic modulus and damping capacity depend also upon the dimensionless ratio G_R/G_u, just as the friction factor depends upon the roughness ratio as well as the Reynolds number. This ratio G_R/G_u has been shown by Zener[6] to depend only on the Poisson ratio.

This method of approach does not, however, enable the effect of grain-size to be introduced; but a method based on Ke's own argument may be used for this purpose. If a crystal is supported a distance d away from another crystal by a liquid of viscosity η, and a shear stress τ is applied to it, it will move with a steady velocity

$$v = \frac{\tau \cdot d}{\eta}. \qquad (6)$$

The relaxation time $\bar{t}$ is proportional to the time for the crystal to move with velocity v a distance proportional to the amount of elastic shear in its own cross-section, namely, a distance $D\tau/\bar{G}$, where D is the mean dimension of the crystal. Hence

$$\bar{t}' = D\tau/v\bar{G} = D \cdot \eta/d\bar{G}. \qquad (7)$$

The corrected dimensionless parameter is thus

$$N_2 = \omega\bar{t}' = \frac{\omega \cdot D \cdot \eta}{d\bar{G}}, \qquad (8)$$

so that the effect of grain-size enters as the dimensionless ratio of the grain-size to the boundary-layer thickness. Since the latter is almost certainly independent of the grain-size, N_2 is the dimensionless form of Ke's parameter (1). It will be of considerable interest to see whether the results can be transferred from one metal to another by means of this parameter, either by deriving a value of η, the effective grain-boundary viscosity for each metal, or, by deriving a value of η/d, the coefficient of boundary slip. From the point of view of dimensional analysis either is, of course, suitable, because d, the boundary-layer thickness, is likely to be a property of the particular metal concerned, since Mott's work[7] shows that the boundary is merely a surface of contact of two crystals. Mott's paper further leads to the suggestion that for different metals η/d should be a function of the dimensionless quantity H/L, where L is the latent heat of fusion. In any event, however, similarity theory may provide a useful link between Ke's empirical formula and fundamental theory, if it can be shown that the values of η/d necessary to bring the results for different metals on to the same curve represent properties of these metals which appear also in other phenomena.

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Dissociation Energy of Carbon Monoxide

A SUMMARY of the various recent views on the dissociation energy of carbon monoxide is given by Gaydon[1] in his "Dissociation Energies", in which he eliminates all proposed values except 11·11 and 9·85 eV., and finally accepts the former as being the more probable. At about the same time, Kenty, Aicher, Noel, Paritsky and Paolino[2] observed a new band system of molecular oxygen in a gas discharge containing carbon dioxide which suggested a lower limit for D (CO) of 9·4 eV. Since then, Hagstrum[3] has defended his electron-impact value of 9·6 eV., Gëro[4] through Valatin[5] still retains faith in 6·9 eV., and Brewer, Gilles and Jenkins[6] have made a determination of the heat of sublimation of graphite which indirectly supports 11·1 eV. Due to this confusion, which has now persisted for some time, the spectroscopic method of evaluating dissociation energies is in danger of being regarded with cynicism by those physical and organic chemists who urgently need this constant for carbon monoxide. The trouble lies in the lack of any dissociation continuum in the spectrum of carbon monoxide, and accordingly attention has been centred on predissociation phenomena, of which there seems no lack.

I have been working on the electron configurations of the various excited states and have been attracted by the F$^1\Pi$-state. This has such a large $x\omega$ (198 cm.$^{-1}$) that it has probably the flattest potential energy curve of all the states of carbon monoxide and consequently the smallest D value. A linear extrapolation gives 0·5 eV., and if we know the dissociation products it is clear that D for the ground state can be determined without appealing to predissociation. Now this state is definitely a singlet because of the high intensity of the F $\leftarrow$ $X^1\Sigma$-transition, and consequently must dissociate into either two triplet atoms ^3P(C) + ^3P(O) or two singlets. The former possibility can be ruled out, and the most probable pair of atoms is ^1D(C) + ^1D(O). The energy difference between ^3P(C) + ^3P(O), the ground-state products, and ^1D(C) + ^1D(O) being 3·3 eV., we find 9·6 eV. for D(CO), and if we allow 0·3 eV. as a possible error in the extrapolation of the F-state, the D-value will be uncertain by this amount. This estimate is in agreement with either the predissociation value of 9·85 eV. or Hagstrum's 9·6 $\pm$ 0·1 eV., and leads to a value for L(C) of 130–140 kcal.

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OF the many values which have been suggested for D(CO), the high value of 11·1 eV. and Hagstrum's value of 9·61 eV. seem most likely, as recently pointed out[1]. Dr. Howell's discussion of the F$^1\Pi$-state certainly gives strong support to the latter value. It should be remembered, however, that Birge–Sponer extrapolations for highly excited states may not be