

It will be seen that the maximum slope of the curve increases with decrease in the nitrate ion concentration, that of specimen *D* being about 2, in agreement with Benton and Cunningham's results. Specimen *G*, however, exhibits a slope not much greater than 1, while the slope of *B* increases continually up to a value of about 6, and in fact the decomposition of this specimen follows an exponential equation of the type $dx/dt = qe^{kt}$. Thus two mechanisms appear to be concerned, one predominating in *B* and the other in *G*, while *D* is an intermediate case showing some of the characteristics of both. It is clear from these curves that there is no real evidence that the theoretical equation is $dx/dt = kt^2$.

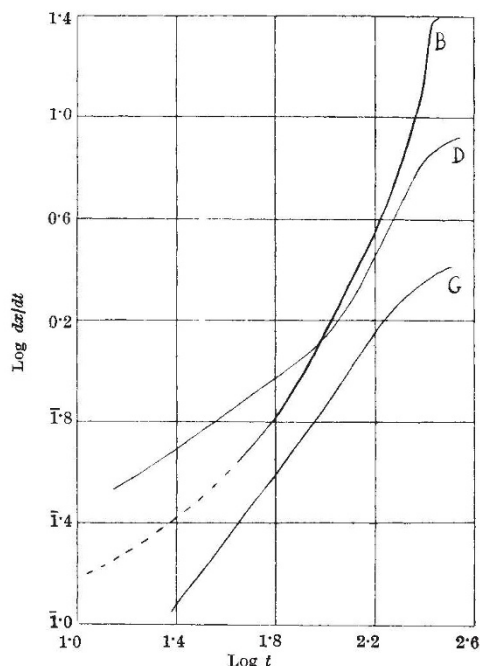


FIG. 1.

Further, Benton and Cunningham find that when the samples have been nucleated by preliminary exposure to light, the value of *m* decreases, figures so low as 0.4 being found. From this they conclude that the fundamental reaction in these circumstances is the growth of nuclei at approximately equal rates in the three dimensions of the crystal (*m* = 2). Our experiments are in substantial agreement, and we find that *m* = 1.05, as an average of twenty-one experiments in which either (a) nucleation was increased by light or (b) the process which predominates in specimen *B* was suppressed. From this we conclude that the fundamental process is the two-dimensional decomposition of nuclei along the planes of the crystal. With this mechanism, it is possible for branching to occur, and this explains the exponential term found in certain decompositions. Moreover, if the branching takes place preferentially on the surface of the crystal, then the effect of ionic adsorption becomes clear. The replacement of oxalate by nitrate ions will reduce the number of possible bridges by which the decomposition can spread from one layer to another.

So far as we can see, the only mechanism by which the three-dimensional decomposition of nuclei could lead to an exponential equation is for the reaction

to spread from one crystal to its neighbours by contact infection. This hypothesis was disproved by dispersing the crystals in oil and in gelatin. The results were most striking, especially in the former case, when a curve with two maxima was obtained. The first acceleration, about 2 per cent of the whole decomposition, was identical with the decomposition of the same specimen *in vacuo*, and obeyed the equation $dx/dt = kt$, representing the decomposition of nuclei present at the start. The second acceleration followed the exponential law, but was very much slower than the corresponding portion of the vacuum decomposition, the time of half-reaction being about ten times as great.

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¹ *J. Amer. Chem. Soc.*, 57, 2227.

Vibrations of Rods and Disks

IN an interesting paper¹ recently published, Dr. A. B. Wood gives some experimental results for the frequencies of free circular plates, vibrating with (a) two nodal diameters, and (b) one nodal circle. Disks with ratios (*t/d*) of thickness to diameter from 0.014 to 0.207 are considered, and it is shown that as this ratio increases, the theoretical and experimental values of the frequencies differ considerably. As some work on this subject which I did in 1932² seems to have escaped attention, it seems worth while to review here one or two of the results which were obtained at that time.

Disks and rods were used with ratios *t/d* from 0.046 to 6.4. It was found that the frequencies for each of the two types of vibration increased linearly with thickness of disk as predicted by theory when *t/d* was very small, but increased more slowly as *t/d* became larger, and finally approached asymptotically a constant value for *t/d* greater than about 1.5. The empirical expression, $f = A/a (1 - e^{-kt/a})$, where *f* = frequency, *a* = radius of disk, *t* = thickness, and *A* and *k* are constants, expresses the relation between frequency and disk dimensions over the whole range of *t/d* considered. When *t/d* is small, the formula is shown to reduce to Kirchhoff's and Poisson's formula, that is, $f = Kct/a^2$, where *K* is a constant, different for each mode of vibration.

In my paper the classical formulæ were wrongly quoted, the constant in each being given as about double its correct value. My experimental values for the constant *K* of 0.288 and 0.512 should be compared with the theoretical ones of 0.261 and 0.410, instead of 0.52 and 0.88. These experimental values were obtained by using 5.2×10^5 for the velocity of sound in duralumin. If a larger figure had been used, particularly in the case for one nodal circle (constant = 0.41), correspondingly better agreement between experiment and theory would have been obtained. In this connexion it may be noted that Dr. Wood, by assuming the theoretical constant to be correct, obtained larger values for the velocity of sound from observations on the vibration with one nodal circle than on the one with two nodal diameters.

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¹ *Proc. Phys. Soc.*, 47, 794-799 (1935).
² *Can. J. Res.*, 8, 563-574 (1933).