Ebulliometric Method of Determining the Amount of a Substance Adsorbed on the Surface of Solid Substances

EBULLIOMETRIC apparatus with a few dephlegmators constructed by W. Swietosławski, applied to the determination of very small quantities of impurities[1], can be used to investigate the amount of substances adsorbed on the surfaces of solid materials such as glass or metals.

The ebulliometer is filled with a substance which gives an azeotropic mixture with that adsorbed. At the beginning of the measurement, the liquid in the apparatus is allowed to boil, the distribution of temperatures is noted, and afterwards it is cooled down. The adsorbing system is placed in the tube with vapour of the substance to be adsorbed, then cleaned with a stream of dry air, and introduced into the column of the apparatus. After heating up again the liquid in the ebulliometer, its vapour flows to the column and removes the adsorbed substance from the surface of the adsorbent, and forms the azeotropic mixture which rises to the upper section of the apparatus. There a considerable lowering of the temperature of condensation of vapours is observed. Then a known amount of the same substance that was adsorbed is introduced into the apparatus, in order to find the lowering of the temperature of condensation produced by 1 mgm. of the substance under investigation. From the lowering caused by 1 mgm. and that produced by the substance adsorbed it is possible to calculate the amount of the substance adsorbed on 1 sq. cm. of the surface of the investigated materials.

Investigations were carried out with benzene vapour adsorbed on the surface of glass and copper at 18° C. In the ebulliometer there was an azeotropic mixture of ethanol and water. The numerical data obtained for these systems are as follows :

Amount of benzene adsorbed on 1 cm.^{2} at 18° C.

Amount of benzene adsorbed on 1 cm.^{2}.

Glass		Copper	
0·00019	mgm.	0·00026	mgm.
0·00034	,,	0·00052	,,
0·00023	,,	0·00022	,,
0·00029	,,	0·00035	,,
Average 0·00026	,,	Average 0·00034	,,

Details will be published shortly.

M. WOJCIECHOWSKI.
Institute of Physical Chemistry,
    Polytechnic High School,
        Warsaw.

[1] See the foregoing letter of W. Swietosławski.

Compressibility of Electrolytic Solutions

THE adiabatic compressibilities of some strong electrolytes have been measured as a function of the molar concentration c by means of a new optical method, which has been developed in the Department of Electrolytic Research of the University of Cologne. It was found that the linear dependence of the apparent molal compressibility on the square root of the concentration is valid (within the experimental error of 0·1 per thousand), also in dilute solutions, even in solutions ten times more dilute than those on which Gucker[1] based his calculations.

The limiting slopes derived from the interionic attraction theory by Gucker agree with our new experimental results only for the 1-1- and 1-2-valent salts, whereas in the case of electrolytes of higher valency a smaller slope was measured than that expected by theory. Different electrolytes of the same valency type show individual characteristics, a fact which Gucker was the first to point out[2].

The compressibility, k, as a function of c is given by the following relation : $k = Ac + Bc^{3/2}$. Gucker supposed that the apparent molal compressibility of non-electrolytes is also governed by the square root law with respect to c. This was not confirmed by our new measurements on cane sugar. We intend to make a further improvement in the experimental method by determining the middle of the nodal lines by a photometric method. It will then be possible to reach the region which is of special interest for the interionic attraction theory. Many other problems will be of great interest : for example, the effect of dielectric constant or temperature upon the compressibility.

A detailed account of the work will be published soon by one of us.

H. FALKENHAGEN.
CH. BACHEM.
Abteilung für Elektrolytforschung am
Physikalischen Institut der Universität,
        Köln.
            March 29.

[1] F. T. Gucker, *J. Amer. Chem. Soc.*, **55**, 2709 ; 1933. *Chem. Rev.*, **13**, 111 ; 1933.
[2] The theory by La Mer, Gronwall, Sandved may be able to give an explanation of this behaviour. See Falkenhagen's monograph on "Electrolytes", Clarendon Press, Oxford, 1934.

Mathematical Psychology of War

As NATURE has encouraged scientific workers to think about public affairs, I beg space to remark that equations, describing the onset of the War, and published under the above title* in 1919, have again a topical interest, in connexion with the present regrettable rearmament. In revised form :

$$\frac{dx_1}{dt} = k_{12}.x_2 - \gamma_1 x_1 + \triangle_1 ;$$

$$\frac{dx_2}{dt} = k_{21}.x_1 - \gamma_2 x_2 + \triangle_2.$$

The suffixes 1 and 2 refer to the opposing nations, or groups of nations. The symbol x denotes the variable preparedness for war ; t is the time ; k is a defence-coefficient' and is positive and more or less constant ; γ is a 'fatigue and expense' coefficient and is also positive and moderately constant. Lastly, $\triangle$ represents those dissatisfactions-with-treaties, which tend to provoke a breach of the peace.

If $\triangle_1$, $\triangle_2$, x_1, x_2 could all have been made zero simultaneously, the equations show that x_1 and x_2 would have remained zero. That ideal condition would have been permanent peace by disarmament-and-satisfaction. The equations further imply that mutual disarmament without satisfaction is not permanent, for if x_1 and x_2 instantaneously vanish, $dx_1/dt = \triangle_1$ and $dx_2/dt = \triangle_2$.

Unilateral disarmament corresponds to putting $x_2 = 0$ at a certain instant. We have at that time :

$$\frac{dx_1}{dt} = -\gamma_1 x_1 + \triangle_1 ;$$

$$\frac{dx_2}{dt} = k_{21}.x_1 + \triangle_2.$$

* Obtainable from Geneva Research Center. 2 Place Chateaubriand, Geneva, price 5s. post paid. Few copies remain.