

Fig. 1. Area = 2.5 m.<sup>2</sup>/mgm.

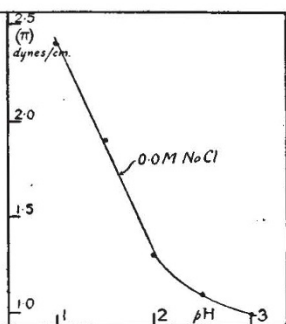


Fig. 2. Area = 0.5 m.<sup>2</sup>/mgm.

as deduced by Philipp<sup>4</sup> from the Gouy-Chapman treatment of the ionic distribution in the electrical double layer. At areas smaller than  $A_2$ , where it is impossible for all the film to remain in the surface, the action of both acid and salt appears to be that of 'salting-out' agents, the increasing ionic strength necessitating more work to cause displacement.

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<sup>1</sup> Gorter and Grendel, *Trans. Farad. Soc.*, **22**, 477 (1926). Langmuir and Waugh, *J. Amer. Chem. Soc.*, **62**, 2771 (1940).  
<sup>2</sup> Seastone, *J. Gen. Physiol.*, **21**, 621 (1938). Bull, *J. Amer. Chem. Soc.*, **67**, 4 (1945).  
<sup>3</sup> Bowes and Kenten, *Biochem. J.*, **43**, 358 (1948).  
<sup>4</sup> Philipp, "On the Nature of Proteins" (Amsterdam, 1936).

### Measurement of the Elasto-Plastic Properties of Gels

Cheftel and Mocquard<sup>1</sup> used the deflexion of a vane embedded in a gel to record the relation between the deformation of the gel and the applied force.

Goldsmith and Iball<sup>2</sup> showed that, if the vane is attached to a torsion wire and deflected by an angle  $\delta$  with the torsion head turned through an angle  $\alpha$ , the blade deflexion at time  $t$  is given by

$$\ln \{ \alpha / (\alpha - \delta) \} = C t k / \Psi, \quad (1)$$

where  $C$  is a constant of the instrument,  $\Psi$  a constant of the gel denoting its firmness and  $k$  the dissipation coefficient. Equation (1), which thus permits calculation of the 'firmness intensity factor'  $\Psi$ , was found to be applicable to a number of different milk curds for which the index  $\beta$  of the applied stress was unity and where the elastic limit was exceeded at a negligibly small applied stress.

Further experiments have shown that the torsion method can also be used to find the rheological properties of gels which possess considerable elasticity. In this case, the apparent 'firmness intensity factor' is composed of an elastic and plastic component, the former being independent of time and thus determined by the shear strain at  $t \approx 0$ , whereas the latter is dependent on the relation between shear strain and time at  $t > 0$ . A modification of equation (1) is thus necessary to account for the elasticity of the gel, the modified equation taking the form:

$$\ln \{ \alpha / (\alpha - \delta) \} = C(1/E + t k / \Psi), \quad (2)$$

where  $E$  is the modulus of elasticity.

The following figures were obtained by means of equation (2) for the gels formed by 1 per cent solutions of commercial soaps at 25° C. ( $\beta = 1$ ).

Sample	$E$ (dynes/cm. <sup>2</sup> )	$\psi$ (c.g.s. units)	$k$
I	7.0	261	0.590
II	27.1	172	0.402
III	42.7	78.5	0.256

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### Volatility of the Oxides of Tungsten and Molybdenum in the Presence of Water Vapour

ACCORDING to L. Wöhler and O. Balz<sup>1,2</sup>, the oxides  $WO_3$ ,  $W_2O_6$  ( $W_4O_{11}$ ) and  $WO_2$  volatilize considerably above 800-900° C., and the vapour pressure of tungsten trioxide is, according to O. Ruff and Grieger<sup>3,2</sup>, 0.206 mm. at 1,023° C. It is generally believed that this phenomenon explains the formation of much larger metal grains during the reduction of tungsten trioxide in hydrogen at 800-900° C. from much finer oxide grains.

Our experiments have, however, shown that the known oxides,  $WO_3$ ,  $W_4O_{11}$  and  $WO_2$ , do not sublime at an appreciable rate under 1,000° C. either *in vacuo* or in a stream of a neutral gas. For example, 0.5 gm. of any of the oxides in a quartz tube at a pressure of 1/1,000 mm. gave only insignificant traces on the cold part of the tube during 58 hr. at 1,000° C., and only 1-5 mgm. during 8 hr. at 1,300° C. Similarly, less than 0.5 gm. volatilized at 1,000° C. during 1 hr. of the same quantity of  $WO_3$  in a stream of oxygen (velocity 100 l./hr./2 sq. cm.) and an even smaller quantity of  $W_4O_{11}$  or  $WO_2$  in a stream of purified argon (velocity 10 l./hr./2 sq. cm.).

The known oxides of tungsten volatilize, however, readily at 1,000° C. at a pressure of 1 atm. in the presence of water vapour (see Table 1).

This table clearly indicates that, under these conditions, the sublimation of  $WO_3$  in moist air, oxygen

Table 1

1 atm., 1,000° C.							
	Carrier gas	Water (vol. %)	$v_s$ streaming velocity (l./hr./2 sq. cm.)	Time (hr.)	Weight of oxide (mgm.)	$m$ , sublimed mass (mgm.)	$k$
$WO_3$	Oxygen	0	100	1	470	0.3	—
		0.4	100	1	490	1.2	30
		2	4	1	460	1.6	40
		29	113	1	470	120.6	39
		75	40	1/2	480	70.5	30
		100	30	1/2	470	81.3	30
$W_4O_{11}$	Argon Hydrogen	0	10	1	510	0.1	—
		86	34	1/2	540	63.3	24
$WO_2$	Argon Hydrogen	0	10	1	330	0	—
		59	41	1	140	39.6	37