reasonable results[2,3] (so long as the gas through which the incident radiation passes is at fairly uniform temperature) the excitation is unlikely to be a chemiluminescent effect in these cases. Since it is equally unlikely that hydrogen atoms assist in the quenching of excited sodium, we consider that the part played by the hydrogen atoms is to cause the formation of free sodium atoms from its salt according to the equation

$$\mathrm{Na}X + \mathrm{H} \rightarrow \mathrm{H}X + \mathrm{Na}.$$

If X is halogen, this reaction is nearly thermally neutral, the heat evolved being 4·4 k.cal. for the chloride, − 5·3 k.cal. for the bromide, and − 8·3 k.cal. for the iodide. In contrast, the dissociation reactions of the type $\mathrm{Na}X \rightarrow \mathrm{Na} + X$ are strongly endothermic, the dissociation energy being greatest in the case of the chloride (97·7 k.cal.) and smallest in that of the iodide (71·7 k.cal.[4]).

Since the line-reversal method for measuring gas temperatures is essentially a null method, it will be clear that the explanation given fully accords with the facts, namely, that the intensity of the line is a function of the hydrogen-atom concentration (and the nature of the sodium salt) and the reversal point a function of the ambient temperature.

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The Meyer Law for Hardness Tests

THE indentation test, made by forcing an undeformable ball into the test piece, of which the Brinell test is the most extended form, is governed by an empirical relation between load and diameter, $P = a\,d^n$, due to Meyer.

The constants a and n are frequently employed for estimating strain-hardening, since a increases, while n decreases with work-hardening. The law can be checked and a new meaning can be given to these constants, starting from classical laws of elasticity.

According to Hertz[1], the depth of the indentation or its diameter is given by

$$h = \frac{9}{64}\left(\frac{1-\nu}{G}\right)^2 \frac{P^2}{R}$$

$$d^3 = 3\left(\frac{1-\nu}{G}\right) P.R,$$

where G is the modulus of rigidity and ν the reciprocal of Poisson's ratio. If Young's modulus is used, the second equation becomes:

$$d^3 = \frac{3(1-\nu^2)}{E} P.D, \qquad (1)$$

where D is the ball diameter. Therefore, in the elastic range, Meyer hardness number is easily seen to be

$$H_M = \frac{4P}{\pi d^2} = \frac{4E}{3\pi(1-\nu^2)}\frac{d}{D}. \qquad (2)$$

Poeschl[2] suggested that this equation could be employed in the plastic range, maintaining the formal similarity, but replacing the constant E by an empirical value obtained experimentally, in the plastic range, by an indentation test. Replacing Young's modulus E by an instantaneous plastic modulus π, we have found that its rate of variation with increasing strain is of the form:

$$\pi = E\left(\frac{d_0}{d}\right)^\eta, \qquad (3)$$

so that π represents the above-mentioned modulus of plasticity and d_0 and η are constants. The equation has been tested within the range of values $0{\cdot}1 < d/D < 0{\cdot}7$, and it has been proved correct whatever the ball diameter. Going beyond lower values $d/D = 0{\cdot}1$, the modulus π should increase, approaching E. This assumption enables us to establish an indentation elastic point, the impression diameter of which would be d_0.

Substituting (3) in $P = \frac{\pi}{3(1-\nu^2)}\frac{d^3}{D}$ gives

$$P = \frac{E.d_0^{\eta}}{3(1-\nu^2)D}.\,d^{3-\eta}; \qquad (4)$$

therefore, the constants of the Meyer Law are

$$a = \frac{E.d_0^{\eta}}{3(1-\nu^2)D} \quad \text{and} \quad n = 3 - \eta.$$

By adopting, provisionally, values for E determined in homogeneous compression tests, taking $\nu = 0{\cdot}3$ and extending logarithmic diagrams, $\log \pi = f[\log d/D]$, down to $\pi = E$, and reading, then, the value of d_0/D, it is possible to compute a and n. From the accompanying table, it can be seen that the calculated values are consistent with the experimental ones.

Material	$E.10^{-3}$	Mean values from 2-, 5-, 5- and 10-mm. diameter balls		Calculated values (eq. 3)		Elastic limit	
		n	$a.Dn^{-2}$	n	$a.Dn^{-2}$	H_0 (kgm./mm.^{2})	Hertzian hardness p_m
Copper	12·7	2·31	52	2·31	50·8	8·45	3·17
70/30-Brass	9·15	2·27	59·9	2·24	61·1	16	6·45
Aluminium (commercial)	7·1	2·33	61	2·31	66·1	13·8	5·2
Soft steel	21	2·36	159	2·37	157	22·3	8·4

From (4) an elastic hardness relationship could also be found:

$$H_0 = \frac{4E}{3\pi(1-\nu^2)}\frac{d_0}{D}.$$

H_0 is the "mean pressure strainless indentation hardness", which represents simply an extrapolation of the Meyer Law. The Hertzian hardness, that is, the maximal pressure on the middle of the impression, is given by:

$$p_m = \frac{E}{2\pi(1-\nu^2)}\frac{d_0}{D}. \qquad (5)$$

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