in the $3d^9$ 4s level and a hydrogen atom may result in bringing the copper atom to the $3d^{10}$ level and exciting the hydrogen atom to higher levels.

It is also observed that the injection of steam or hydrogen greatly modifies the intensity of a number of copper lines, especially in the region below λ 3000. A detailed analysis of the lines which are so modified will give a clue to the nature of the collision processes involved in the arc.

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GEL-FORMATION BY MUTUAL INTERACTION OF OPPOSITELY CHARGED SOLS

A STUDY of the literature reveals that most of the inorganic gels have been prepared by the following two methods:

(*i*) Metathetical reaction: In this method solutions of definite concentrations of substances which on reacting give rise to the gel-forming substance, are mixed in suitable proportions. The resultant mixture is clear in some cases (silicic acid)[1] while in others[2,3] a precipitate is obtained which disappears on slight or vigorous shaking.

(*ii*) Addition of an electrolyte to a sol: In this case certain electrolytes of suitable concentration are added to a fairly concentrated sol of the gel-forming substance, dialysed to a certain extent.[4]

However, other methods, such as the action of α-, β- and X-rays on a sol (Fernau and Pauli),[5] addition of non-electrolytes to a sol (Freundlich),[6] dilution of a true solution of a gel-forming substance (Prasad and Desai),[3] have been used in particular cases.

The authors have discovered that transparent or translucent gels are formed when oppositely charged sols of suitable concentrations, dialysed and undialysed, are mixed together in proper proportions. So far as the authors are aware it has always been observed that mutual coagulation takes place when oppositely charged sols are mixed together in proper proportions. The formation of gels by mixing oppositely charged sols seems to be a new observation. The first observations were made on mixing the sol of nickel hydroxide (negatively charged) with sols of ferric and aluminium hydroxide (positively charged). The nickel hydroxide sol was prepared by shaking with distilled water the gel obtained by the addition of NaOH solution to a saturated solution of nickel hydroxide in tartaric acid and its colloidal content corresponded to 3·01 g. of nickel per litre of the sol. The ferric and aluminium hydroxide sols were prepared by the hydrolysis of ferric chloride and aluminium acetate, respectively, and their colloidal contents were found to correspond to 3·05 g. of Fe_2O_3 and 2·34 g. of Al_2O_3, respectively, per litre of the sols. Gels were obtained when 5 c.c. of the nickel hydroxide sol were mixed with the following volumes of the ferric hydroxide sol dialysed to different extent.

TABLE I

Days of dialysis	Volume limits
0	1·30—1·55 c.c.
1	1·70 - 2·40 ,,
2	2·35—3·05 ,,
3	3·50—4·20 ,,
4	5·30 - 5·80 ,,
5	5·25—6·75 ,,

Gels have now been obtained on mixing (*i*) the sol of aluminium hydroxide (+ve) with sols of manganese dioxide (—ve), antimony sulphide (—ve) and silicic acid (—ve), and (*ii*) the sols of ferric hydroxide (—ve) and silicic acid (+ve).

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1. Prasad and Hattiangadi, *J. Indian Chem. Soc.*, 1929, **6**, 653. 2. Prakash and Dhar, *Ibid.*, 1929, **6**, 587; 1930, **7**, 367. 3. Prasad and Desai, *J. Univ. Bom.*, 1938, **7**, 132. 4. Freundlich and Leonhardt, *Koll. Beih.*, 1915, **7**, 195; Weiser, *J. Phys. Chem.*, 1922, **26**, 418, 681; Schleck and Szegvari, *Koll. Z.*, 1932, **60**, 1847; Prakash, *Koll. Z.*, 1932 **60**, 184; *J. Indian Chem. Soc.* 1932, **9**, 193. 5. Fernau and Pauli, *Koll. Z.*, 1917, **20**, 20. 6. Freundlich, *Ibid.*, 1928, **45**, 348.

PARACHORS AND MOLECULAR DIAMETERS

THE mean value of $\frac{[P]}{V_0}$ is 2·873,[1] where [P] is the parachor and V_0 is the zero volume at absolute zero. At absolute zero, parachor can be written as

$$[P] = \frac{M}{D_0 - d_0}\gamma_0^{1/4} = V_0\gamma_0^{1/4},$$

all the terms involved having their usual significance.

So, $\frac{[P]}{V_0} = \gamma_0^{1/4} = 2{\cdot}873$. Hence, $\gamma_0 = 68{\cdot}2$ for a majority of substances. However, it has been observed that γ_0 varies between 60 and 80 for many organic substances.[2] But, for purposes to be described below, the value of γ_0 may be taken as a constant for all normal substances.

The following equation[3] gives a relation between density and temperature;

$$D_0 = \frac{D - d}{(1 - T_r)^{3/10}}$$

$$\text{Since } V_0 = \frac{[P]}{2{\cdot}873} = \frac{M}{D_0},\ D_0 = \frac{M.\ 2{\cdot}873}{[P]}.$$