effect with the dichromate. 500 gm. of dichromate were, therefore, irradiated with neutrons and dissolved in several litres of water which contained 200 mgm. of chromium sulphate. The latter was precipitated by ammonia and the hydroxide separated by centrifuging. The activity of the precipitate was found to be of the order of 100–300 counts/min., whereas the total activity of the dichromate was 30,000 or more counts/min.

Thus, if a Szilard and Chalmers effect does exist in this case, it is extremely weak.

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Evidence for the Formation of a Copper Carbonyl

IN order to explain the 'metallization of insects' observed by Zelinski¹, and his own observation of a copper mirror produced by passing carbon dioxide through a heated tube containing a mixture of copper oxide and charcoal, Bertrand² postulated the intermediate formation of a copper carbonyl. Mond and Heberlein³, being unable to reproduce Bertrand's results, were of the opinion that the deposition of the copper mirror was caused by the adhesion and sintering of copper oxide helped by its heat of reduction by carbon monoxide. The existence of a copper carbonyl has also been postulated by Boomer, Morris and Argue⁴ to explain the removal of copper from the metallic catalyst during the synthesis of methanol.

In order to remove traces of oxygen from carbon monoxide, I heated a roll of copper gauze (initially slightly oxidized at the end of the roll nearest to the point of entry of the gas) in a glass combustion tube, by means of an electric furnace, the temperature in the centre of which was maintained at about 550° C. while the carbon monoxide (containing a little air, but no chloride) was being passed through the tube. During the course of several weeks of continuous heating in the stream of carbon monoxide, a substantial copper mirror was formed in the section of the tube which had attained a temperature of about 250–400° C., and a purple mirror in the centre section (550° C.). As the copper gauze was only in contact with the glass tube at a few points, and copper is non-volatile at the temperatures of the experiment, this phenomenon can best be explained by the formation of a very minute quantity of copper carbonyl at about 250° C., and its subsequent decomposition at higher temperatures. The purple coloration is due to interaction between the deposited metallic copper and the glass at the highest temperature (cf. Mond and Heberlein). A similar experiment using nitrogen instead of carbon monoxide did not produce a copper mirror, the glass tube remaining quite clear.

The fact that a copper mirror was deposited in a part of the tube where no copper oxide was present at any time means that Mond's criticism of Bertrand's experiments is inapplicable in this case. A minute deposit of a brown substance (free from chloride) in the cooler part of the glass tube may be the actual carbonyl. Tests were made for the presence of a chloride impurity, which could produce a white

sublimate of cuprous chloride (cf. Robinson and Stainthorpe⁵), but this was found to be absent.

It is planned to carry out further investigations on this subject.

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¹ Zelinski, *C.R. Acad. Sci. Paris*, **177**, 1041 (1923).

² Bertrand, *C.R. Acad. Sci. Paris*, **177**, 997 (1923); *Bull. Soc. Chim.*, **35**, 41 (1923).

³ Mond and Heberlein, *J. Chem. Soc.*, **125**, 1222 (1924).

⁴ Boomer, Morris and Argue, *Nature*, **129**, 438 (1932).

⁵ Robinson and Stainthorpe, *Nature*, **153**, 24, 593 (1944).

Hydrogen Overpotential and the Thermionic Work Function

EXTENSIVE recent work^{1,2} on the hydrogen overpotentials at a large number of metal electrodes in aqueous solution allows a re-evaluation (see ref. 3) to be made of the relation between the hydrogen overpotential at various cathodes and the position of the cathode material in the periodic table. In the accompanying graph, the available values^{1,2} for the hydrogen overpotential at the intermediate current density of 10⁻³ amp./sq. cm. at various cathode materials, the surfaces of which have been prepared in approximately the same way, are shown in relation to the atomic number of the metals concerned, from which a periodic variation may clearly be discerned.

It is of interest to compare this variation with the corresponding one for the thermionic work functions of the metals⁴. From the graph it seems that if, on transition from one metal to another, the second has a smaller overpotential than the first, then the second has a larger work function than the first, and *vice versa*. This relation appears to hold in every case for which data are available. There is also a general tendency for metals at which there is a comparatively low overpotential to have a comparatively high work function. The tendency for the converse is less marked.