

however, a neutral solution of hydrogen peroxide² was added the normal sensitivity continued throughout; a potential difference persisted to within 0.3 to 0.4 cc. of 0.1 *N* titrating solution of the end-point, then began slowly to decrease and at the neutral point a clear, sharp, downward break occurred. With the reversed titration a rise preceded the end-point which was marked by an upward break of about 100 mv. A slight excess of acid caused the voltage to fall. In both cases the point of maximum velocity of potential change was exactly coincident with the "green point" of bromothymol-sulfonephthalein which corresponds to a P_H value of 6.8. In neither case was the end-point permanent. The rapid stirring of the solution favored the absorption of carbon dioxide to such an extent that variable results were obtained in consecutive titrations approaching the neutral point from the alkaline side. With the approach on the opposite side the crawl as the end-point was passed was not sufficient to impair seriously the clarity of the break.

The method seems to offer very favorable possibilities for an extensive development of a new type of hydrogen electrode that is unique in its independence of an external gas supply. In view of further work along this line, the publication of which must be delayed, it is desired to call brief attention at this time to this application.

CONTRIBUTION FROM THE
CHEMICAL LABORATORY OF THE
UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN
Received November 27, 1922

H. H. WILLARD AND FLORENCE FENWICK

A Glass-to-Metal Joint.—In constructing a thermostat it became necessary to make a connection between ordinary soft glass and copper tubing. Platinizing, copper plating and soldering according to the method described by McKelvy and Taylor¹ was unsuccessful with soft glass tubing 8 mm. in diameter, as such joints had a tendency to break after they were finished, because of heating strains produced in the glass by the hot solder. A satisfactory joint, free from such strain, was finally constructed in the following manner.

The end of the glass tube was drawn down so that it fitted easily into the copper tube for about a centimeter. It was then platinized and heavily copper plated, over a length of 3 or 4 cm., in the usual manner. The coppered end was polished until it fitted tightly into the copper tube. By

² The hydrogen peroxide used was the ordinary 3% commercial solution; 100 cc. was neutralized with sodium hydroxide, using bromothymol-sulfonephthalein as the indicator, and diluted to 250 cc.; 5 cc. of this solution was added to each sample titrated.

A solution of hydrogen peroxide prepared by neutralizing sodium perborate with hydrochloric acid failed to give satisfactory results. No explanation is advanced for this unexpected behavior.

¹ McKelvy and Taylor, *THIS JOURNAL*, **42**, 1364 (1920).

a suitable arrangement copper was again deposited on both tubes across the joint until they were completely united by a solid mass of deposited copper. It was found very convenient to use as a plating vessel a short section of glass tubing, 3 cm. in diameter, closed at the bottom with a 1-hole rubber stopper. That part of the glass tube to be plated extended through the hole in the stopper into the bath. By sliding the tube up or down through the stopper and by adjusting the height of the liquid, it was very easy to regulate the deposit to the desired position and extent. A copper-sulfate acid bath was used and the current density was kept below 0.1 ampere per sq. cm. It was necessary to remove the tube from the bath and file the deposit occasionally until it became perfectly smooth across the joint. Such a connection is perfectly solid and the glass is free from all heating strains.

A joint of this type was built into a thermostat regulator a year ago and has been entirely satisfactory. A similar joint was made between copper-plated steel tubing, 6 mm. in diameter, and soft glass of the same size. The metal end was soldered shut and the glass tube sealed directly to a manometer system in which a vacuum of less than 1 mm. was produced. During a week of observation no trace of a leak was evident.

Violent changes of temperature, because of the different coefficients of expansion of the glass and metal, evidently tend to weaken the vacuum tightness of the joint. It will stand a reasonable amount of heat, however, as shown by the fact that the above joint became quite hot when the metal tube was soldered within 7.5 cm. of the glass.

CHEMICAL LABORATORY OF THE
OHIO STATE UNIVERSITY
COLUMBUS, OHIO
Received November 18, 1922

MERLE L. DUNDON

[CONTRIBUTION FROM THE LABORATORY OF PLANT CHEMISTRY, UNIVERSITY OF
WISCONSIN]

EXPERIMENTS ON AZULENE¹

BY ROLAND E. KREMERS

Received May 15, 1922

Historical

The blue pigment which is associated with the high-boiling fractions of certain volatile oils has long been known to chemists. Various conjectures as to its nature have been put forward and, indeed, the problem was at one time considered settled by the discovery of copper salts in oils distilled through untinned copper condensers. Even in recent years, no definite knowledge was at hand, and the substance was considered to contain

¹ An abstract based on part of a monograph submitted by Roland E. Kremers to the Graduate Faculty of the University of Wisconsin in partial fulfillment of the requirements for the degree of Doctor of Philosophy, June, 1921.