a rapid stream of hydrogen was passed to prevent access of carbon monoxide to the metal. The resulting bead swelled up and became porous in texture resembling titanium carbide. In the Arsem furnace the resulting material was always porous and contained titanium carbide.

A rough determination of the melting point of the material was carried out as follows: The filament of a Gem incandescent lamp was superimposed on a rod of titanium maintained in as perfect a vacuum as could be obtained by a hammering Boltwood pump.

An increasing current was sent through the titanium rod and the temp. of the Gem filament was gradually raised to an equal intensity. It was found that the titanium rod slowly melted and finally broke when the Gem lamp was burning at an efficiency of 3.55 watts per c. p. The melting temperature is therefore between 1800 and 1850° and is certainly not greater than this latter value. Observations, confirming this result, were also made with a Wanner pyrometer.

The specific gravity of the metal is 4.50. It is therefore appreciably lighter than the metal obtained by Moissan (sp. gr. 4.87).

In conclusion it may be said that the metal titanium is not by any means as refractory a substance as former experimenters have been led to believe. Its melting point is comparatively low—being within one hundred degrees of platinum. Further, though brittle in large pieces in the cold yet at a low red heat it shows a remarkable malleability, and very small beads even in the cold may be flattened out with ease without disruption. A method is here given by means of which moderately large quantities of pure titanium may be produced with ease, so that the air of mystery which has so long enshrouded this refractory element will soon be dispelled.

My thanks are due to Dr. W. R. Whitney, of the General Electric Co., for suggestions and generous sympathy during the progress of this research.

DEPT. OF PHYSICS AND ELECTROCHEMISTRY,
RENSSELAER POLY. INST., TROY, N. Y

## NOTE.

*The Preparation of Platinum Black.*—Of the various methods which have been proposed for the preparation of the finely divided form of platinum known as "platinum black," but two are ordinarily employed, *viz.*, (1) the reduction of a solution of chloroplatinic acid by zinc, and (2) the method of Loew[1] depending on the precipitation of the platinum by means of sodium hydroxide and formaldehyde. In their study of the reducing action of platinum black on nitrates in the presence of formal-

[1] Loew, *Ber.*, 23, 289 (1890).

dehyde, Kastle and Elvove[1] came to the conclusion that platinum black precipitated by means of zinc contains an appreciable amount of the latter metal, the presence of which influences the properties of the black to a greater or less extent, and that this zinc is ordinarily difficult of removal.

It occurred to me that aluminium would be a good metal to use in place of zinc for the production of platinum black, and after a few preliminary experiments, a quantity of black was precipitated by this metal and some of the properties of this preparation investigated.

To prepare this black an aqueous solution of chloroplatinic acid containing 0.5 gram of $PtCl_4$ in 10 cc. is precipitated by the addition of an excess of commercial sheet aluminium. The action is very rapid and generates a great deal of heat. Sufficient strong hydrochloric acid is then added to dissolve any excess of aluminium. When the action is over, the solution presents the uniform black appearance of a strong colloidal solution of platinum, and at the surface of the liquid a platinum mirror is often precipitated on the walls of the container. In this condition, the platinum black will take a long time to settle out, but if the liquid is heated on a steam bath, the black will settle in minute flakes within a couple of hours. The supernatant liquid is usually yellow or greenish, probably from the presence of iron in the aluminium. This liquid is removed by decantation, and the black twice heated for one hour at 100° with fresh quantities of strong hydrochloric acid, which will remove practically all remaining metallic impurities. It is then washed with distilled water by decantation until the wash water gives no test for chlorine with silver nitrate, washed into a small beaker with distilled water, allowed to settle, the excess of water removed by decantation or with a pipette, and the black dried in a vacuum over sulphuric acid, to avoid heating.

The platinum black thus obtained is of a uniform dull black color, and between the fingers reduces to an absolutely impalpable powder. It appears to have a very considerable catalytic power, although quantitative studies of this power were not made at this time.

On analysis, the black thus prepared was found to contain 96.5 per cent. of metallic platinum. In the preliminary experiments, commercial aluminium bronze powder was used as the precipitant, but the black thus obtained was found to be contaminated with a dark brown, amorphous powder of much less specific gravity than the black. This appeared to be a mixture of organic matter and amorphous silicon. With the sheet aluminium the appearance of this contamination was not noted. From the formation of the platinum mirror, it would seem that during the process of precipitation the platinum may actually be in the colloidal

[1] Kastle and Elvove, *Am. Chem. J.*, **31**, 633 (1904).

state for a brief time. This mirror formation has also been noted in the reduction by formaldehyde (Loew's method), and in the reduction with sodium formate. Magnesium and iron also give very finely divided precipitates of platinum black, but the action does not appear to be so violent as with aluminium, and the blacks obtained are denser and more coherent. That from iron appeared to be badly contaminated with carbon, even though a so-called pure iron wire was used. No analysis of it was made.

When heated in the air the following effect upon the weight of the platinum black prepared by precipitation with aluminium was observed: Weight before heating, 0.2661 gram; weight after heating to 300°, 0.2657 gram; weight after heating to redness, 0.2630 gram; or a total loss on heating to redness of about 1.2 per cent., probably representing carbon in the aluminium. Other specimens gave similar figures.

It was also observed that while the platinum black prepared by the use of zinc becomes the gray, "spongy" platinum upon being heated to redness, that precipitated by means of aluminium changes but slightly in color, although it becomes somewhat more coherent.

It therefore appears that by this method one may obtain a quite pure, finely divided platinum black, which will prove useful where this preparation is needed in chemical work. F. ALEX. MCDERMOTT.

HYGIENIC LABORATORY, P. H. AND M. H. S., WASHINGTON, D. C.

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[CONTRIBUTION FROM THE BUREAU OF CHEMISTRY, U. S. DEPT. OF AGRICULTURE.]

# A RELATION BETWEEN THE CHEMICAL CONSTITUTION AND THE OPTICAL ROTATORY POWER OF THE SUGAR LACTONES.[1]

BY C. S. HUDSON.

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## The Hypothesis.

The numerous sugars are strongly rotatory. On the other hand the alcohols which result from their reduction and the acids which are formed by their oxidation are only feebly rotatory; but the glucosidic compounds of the sugars and the lactones of these acids are as strongly rotatory as the sugars themselves. Thus for example the specific rotations of the two forms of glucose are 109° and 20°, of the methyl glucosides 157° and —32°, of gluconic acid lactone 68°, but the rotation of gluconic acid is only —2°, and sorbitol, which is the alcohol that results from the reduction of glucose, shows no rotation. Is there any other property of these substances which varies in the same manner as the rotatory power?

The constitutional chemical formulas now in use for these compounds have been chosen step by step to express their chemical reactivities,

[1] Read at the Boston meeting of the American Chemical Society, Dec., 1909.