

Technische Reichsanstalt—of a well-defined scale of hardness for glass, divided into eight degrees. The following are the typical sorts of glass for each degree :

I. The softest glass in commerce, French crystal.

II. Soft Thuringian glass, used for artificial flowers, toys, etc., English crystal.

III. Hard Thuringian glass, as used for thermometers, finer apparatus, etc.

IV. Jena normal thermometer glass (XVI^m of Schott and Co.).

V. French hard crystal used in Paris for normal thermometers (by Tonnelot).

VI. Jena boro-silicate thermometer glass (59^m of Schott and Co.).

VII. Jena thermometer glass free from alkalis (122^m of Schott and Co.). Both VI and VII are used for high temperature thermometers and many other purposes.

VIII. Cavalier's Bohemian crystal glass, used for combustion tubes, etc.

Normal scales of hardness for glass, arranged according to the above scheme, have been prepared and can be secured through dealers in chemical apparatus. They contain on cardboard, illustrative samples of the results of fusing (as described above), each number in the series with the next following number. Compartments also are well stocked with small rods of each degree on the scale—each rod stamped with its number—to be used for testing.

The use of such a scale brings a most desirable element of certainty into the glass trade as well as into the technique of physical and chemical laboratories, and many industrial operations.

[CONTRIBUTIONS FROM THE ANALYTICAL LABORATORIES OF THE SCHOOL OF MINES, COLUMBIA COLLEGE.—No. 6.]

A METHOD OF DETERMINING THE KOETTSTORFER FIGURE OF DARK-COLORED SUBSTANCES.

BY PARKER C. MCILHINEY, PH.B., A.M.

Received May 5, 1894.

THE Koettstorfer figure of a fat or resin is the number of milligrams of potassium hydroxide required to saponify one gram of the substance. It is determined by adding to a

weighed quantity of the substance a measured excess of an alcoholic solution of potash, evaporating off the alcohol, redissolving in neutral alcohol, and determining the excess of potash by standard hydrochloric acid. When the substance is light in color and the alcohol free from aldehyde, the determination is easily made, but if the substance has much color of its own the end reaction with phenolphthalein is indistinct. The same is true if the alcohol used contains aldehyde, as this gives with caustic potash a red-brown color. The latter difficulty can be surmounted by purifying the alcohol, but the former one is more serious. In experimenting to find a mode of procedure which would obviate the difficulty it was observed that a solution of neutral soap, to which ammonium chloride had been added, when submitted to distillation liberated a quantity of ammonia equivalent to the alkali combined with the soap.

Based on this principle the following method was devised: Two grams of the substance under examination is weighed into an Erlenmeyer flask, an excess of an alcoholic solution of caustic soda added, and the alcohol evaporated off. 250 cc. of ninety-three per cent. alcohol is now added and the solution heated until the soap is dissolved. Carbonic acid gas is now passed through the solution for about one hour. This treatment converts the free caustic alkali present into carbonate and bicarbonate which precipitate. The solution is then filtered into a suitable flask and most of the alcohol distilled off. It is necessary to add a spiral of platinum wire or a piece of sharp pointed metal or glass to prevent boiling over. When most of the alcohol is gone a solution of ten grams of ammonium chloride, in 100 cc. of water, is added and the solution distilled as far as possible, the distillate being caught in twenty cc. of normal hydrochloric acid which is titrated at the end of the operation, using methyl orange as indicator. The amount of hydrochloric acid neutralized by ammonia is equivalent to the combined alkali in the test.

Alcohol of ninety-three per cent. was found to dissolve sodium bicarbonate sufficient to neutralize 0.34 cc. of normal acid for every 100 cc. of alcohol used. A deduction must therefore be made for this in the calculation.

A sample of linseed-oil tested in this way gave a Koettstorfer

figure of 192.4, and by the ordinary process the figure found was 193.1. A sample of dragon's blood resin gave 124.9.

[CONTRIBUTIONS FROM THE CHEMICAL LABORATORY OF THE UNIVERSITY OF CINCINNATI. XLV.]

ON THE VOLATILITY OF BORAX,¹

BY SIGMUND WALDBOTT, PH.D.

THE fact that borax is a volatile substance under ordinary laboratory conditions seems to have, hitherto, escaped notice. No reference is made to it in the literature of pure chemistry, and the following quotation from E. Cramer² would imply a general belief among technical chemists to the contrary:

“The boric acid must not be added in the form of vitreous boric acid, but in the form of sodium borate, whereby no volatilization will take place.”

In the course of an investigation on the borates, carried on in connection with Prof. T. H. Norton, certain observations led to the suspicion that borax was not entirely unaffected by the heat of the ordinary blast-lamp.

A series of quantitative experiments was made, the results of which may be briefly summarized as follows:

If a small amount of pure borax, say four grams, be heated in a platinum crucible of fifty cc. contents, until the water of crystallization is quantitatively given off, and if the residue, borax glass, then be heated over a Bunsen burner for about ten minutes or longer, the weight will be found constant. If the crucible, half covered by the lid, be next heated over a gentle blast-flame, there will be noticed a very slight, yet distinctly perceptible loss in weight, increasing in proportion to the intensity of heat and the time of heating.

If now the uncovered crucible with its contents be subjected to an intense white heat, heavy vapors arise from the surface of the molten borax glass, and if heating is prolonged a very marked decrease in weight becomes evident.

The following experimental results are classified according to the general temperature maintained:

¹ Read before the Cincinnati Section, February 15, 1894.

² E. Cramer, *Thonindustrie-Zeitung*, 1892, p. 155.