

The Capacity of the Capillary Electrometer

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In spite of the fact that the capillary electrometer has been the subject of study ever since the pioneer work of Lippmann¹, the question of the cause of the large capacity and its possible variation with the potential difference cannot be said to have been answered satisfactorily. The controversy over the explanation of electro-capillary phenomena and the existence of an electric double layer at the boundary between a metal and an electrolyte or a gas is still open to contribution and the importance of the question makes advisable the publication of the following investigation.

If the large capacity of the electrometer is due to a double layer such as conceived by Helmholtz,² it might be expected that the properties of this double layer would depend on the difference of potential of the two sides and the capacity³ might be a function of this potential difference. Contrary to the explicit statement of Burch⁴ that the capacity is independent of the difference of potential, preliminary observations showed that the capacity is a function of the potential difference. Also, contrary to his statement of the case, the capacity is very different when the direction of the applied potential is reversed. As ordinarily used, the mercury of the electrometer is the cathode. Otherwise the mercury becomes fouled after a short time and sticking results. Later study of the variations of capacity have confirmed the results obtained earlier, and the following paper is an account of the work carried out in the summer of 1917.

APPARATUS

The form of electrometer used is essentially the same as that used by Burch with a few modifications for convenience in handling and for changing capillaries. The tubing was of the soft, soda-glass variety selected to be free from irregularities. It was washed with hot aqua-regia, water, hot potassium hydroxide and distilled water and finally

¹ Lippmann, Pogg. Ann. 149, 546, 1873; Wied. Ann. II, 320, 1880. Compt. rend. 76, 1407, 1873; 95, 686, 1892. Ann. de Chem. et Phys. (5), 494, 1877; Jour. de Phys. (2) 2, 116, 1883.

² Helmholtz. Wied. Ann. 7, 337, 1879; 16, 30, 1882.

³ The word capacity is used here in the sense of apparent capacity.

⁴ Burch, Electrician (London). July 17, 27, 31, Aug. 7, 1897.