PLASTIC CAPILLARY FOR DROPPING MERCURY ELECTRODE

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Described is a polarographic capillary easily realizable from a commercially available plastic tubing and its performance characteristics are demonstrated.

The polarographic capillary made of a plastic material instead of glass has been used for measurement in hydrofluoric acid and further with the aim to prevent creeping of the solution inside the capillary by using a hydrophobic material. Raaen[1,2] made a capillary tip from a Teflon rod with the orifice made by drilling with a spiral drill while Bond[3,4] pierced the Teflon tip with an electric discharge. The capillary drawn of polyethylene was used by Barker[5] and Novotný and coworkers[6,7] used a polyethylene conical capillary with a spindle-shape cavity for polarography in solutions of fluorides[6] and hydrofluoric acid[7]. Capillaries made of Teflon and polyethylene of various shape are the subject of several patents[8,9]. Tenygl[10] protected in a continuous measurement the orifice of a glass capillary by a thin layer of silicon oil. The oil of a lower specific gravity than water is held by the hydrostatic pressure in a 0·3 mm thick cavity round the orifice and protects the capillary from corrosion and penetration of solution.

To draw plastic capillaries requires a considerable skill. It is difficult to make a required size and a capillary suitable for polarography is chosen on the trial and error basis. In this paper is described a capillary easily relizable from a commercially available plastic tubing.

EXPERIMENTŠL

As a capillary was used the Technicon Instruments[11] tubing used in the Autoanalyzer pump. Suitable is the finest tubing with i.d. 0·127 mm (color code orange-black) or i.d. 0·19 mm (color code orange-red). The tubings are delivered in a standard length of 37 cm, e.d. 2·5 mm, and are flexible. To obtain a rigid capillary suitable for polarography (Fig. 1), the Technicon tubing (1) i.d. 0·127 mm was sealed using paraffine wax into a heavy-walled polyethylene tubing 15 cm long,

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i.d. 4·5 mm. The tubing 1 is connected to a ordinary glass polarographic capillary i.d. 0·08 mm drawn into a needle shape on the lower end. The glass capillary serves as an element for restriction of the mercury flow so that the mercury column height can be 40—60 cm as in ordinary polarography. The polyethylene tubing is fixed into a rubber stopper and the plastic capillary is used in the same way as a glass capillary.

RESULTS AND DISCUSSION

The performance and potential range of the plastic capillary is practically the same as a glass capillary. The plastic capillary can be used in a routine analysis of aqueous solutions and especially in hydrofluoric acid. The formation of mercury drops is very regular and the polarograms obtained are perfectly reproducible (Fig. 2). The advantage of the plastic capillary as compared to a glass one is that a blocked or irregulary dropping electrode can be easily renewed by cutting off a short length of the capillary tip (0·7—1·5 mm) by a blade. This procedure is simple and can be easily done even by the personal without experience which is difficult to do with a glass capillary.

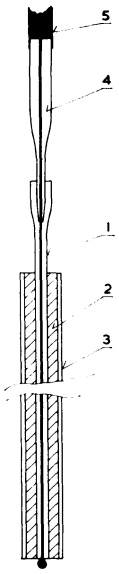

FIG. 1

Construction of the plastic DME. 1 tubing for the Autoanalyzer pump; 2 paraffine wax; 3 polyethylene tubing; 4 glass polarographic capillary; 5 to mercury reservoir

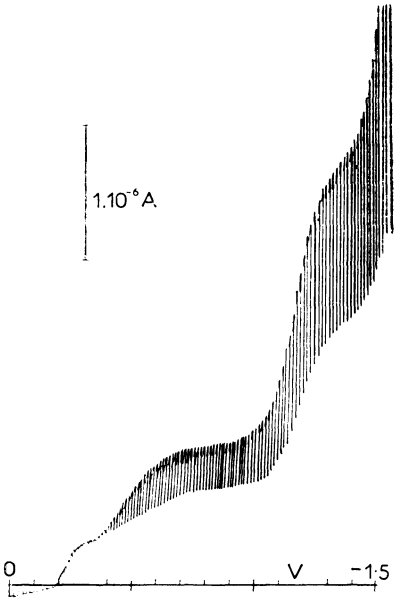

FIG. 2

Performance of the plastic DME. Polarogram of 40% hydrofluoric acid saturated with air. Reference electrode was a carbon rod placed in the same solution. Polarisation rate 400 mV min^{-1}

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