DEVICE FOR AMPEROMETRIC DETERMINATION OF THIOUREA

(EXCHANGE OF EXPERIENCE)

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Thiourea solutions are used in ion-exchange technology for processing gold-containing ores. In this connection, there arose the necessity for monitoring the thiourea concentration in various stages of the process. We have developed a device called a "thioanalyzer" designed for the rapid analysis of aqueous thiourea solutions which do not contain substances capable of easier anode oxidation.

The operating principle of the device is based on the measurement of the limiting current of anode oxidation of thiourea, which is proportional to its concentration. The most convenient operating section of the polarization curve for all thiourea concentrations up to saturation is 1 to 1.25 V (Fig. 1). In this range the change in the anode potential has an insignificant effect on the measurable current strength.

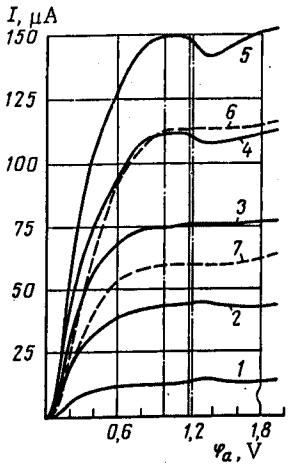

Fig. 1. Anode polarograms of 0.5 N sulfuric acid solutions of thioureas 1) 10; 2) 30; 3) 50; 4) 70; 5) 92 g/liter of thiourea; 6), and 7) polarograms of different samples of commercial regenerate (20.6°C).

The device consists of a measuring block and an electrolytic cell. The latter is a graphite cylinder (which is simultaneously the cathode), in the cover of which a platinum microanode, sealed in glass, is embedded. Since the cathode has an area several orders of magnitude greater than the anode, its potential is virtually constant during passage of current.

The fundamental part of the measuring block is a stabilized power source whose scheme is shown in Fig. 2. The source is assembled on semiconductor diodes D_1-D_6 and transistors T_1-T_4 and is used to maintain in the cell a fixed constant voltage which corresponds to the operating range of the anode potential. The voltage is regulated over several limits with potentiometer R_4 and is controlled by an indicating device when toggle switch S_2 is switched into position I. In position II, the device indicates the thiourea concentration. Since the coefficient of proportionality between the current and the concentration depends on the conditions used in the determination (nature of the background, temperature, stirring), it is experimentally found during calibration and is established by regulatable shunts R_{12} or R_{13}.

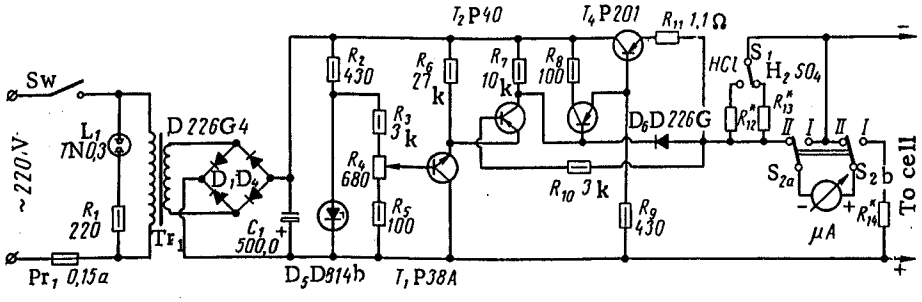

Fig. 2. Schematic of the device.

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TABLE 1. Results of Thiourea Determination (g/liter)

Iodometric method	With the thioanalyzer
77,3	77,0
66,0	63,0
67,0	70,0
74,9	76,0

To improve rhe reproducibility, the platinum microelectrode is washed before the measurements with 4 N HCl + 10% H_2O_2, 2 N NH_4OH, and distilled water [1]. The test solution is then poured into the cell, and the anode potential in the operating range noted on the device scale is established with potentiometer R_4. The thiourea concentration is read off after toggle switch S_2 is switched to position II. The time necessary for the determinations does not exceed a few minutes.

Comparative results of the determination of the thiourea concentration in samples of commercial regenerate (with an ion-exchange apparatus of the Lebedinskii Gold Extraction Factory) are presented in Table 1.

LITERATURE CITED

1. N. N. Kuz'mina and O. A. Songina, Izv. Vuzov., Khim. i Khim. Tekhnologiya, 4, 928 (1961).