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SUMMARY

An apparatus for studying the external photoeffect from the surface of melts and of the resulting solid phases has been described. In addition to the measurement of photocurrents, the apparatus enables melts of different concentration to be prepared without breaking the vacuum in the system or using magnetic valves. The photoelectric properties of a series of melts of different concentration can be studied under identical conditions. The design of the apparatus allows it to remain permanently connected to a getter-ion vacuum pump (GIN-0.005), so that the background pressure of residual gas over the surface of a metallic melt can be maintained at the level of 10^{-8} mmHg.

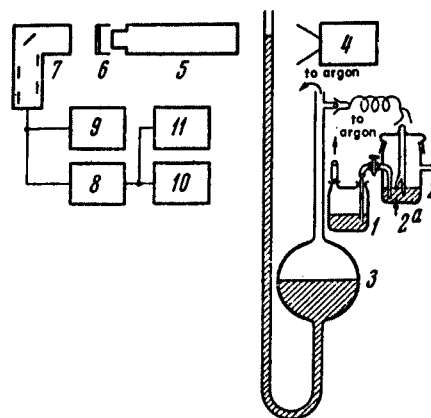


Fig. 1.

1. O. N. Dobretsov, "Elektronnaya i Ionnaya Emissiya" (Electronic and Ionic Emission), Gostekhizdat, Moscow, 1950.
2. P. P. Pugachevich and O. A. Timofeevicheva, Dokl. Akad. Nauk SSSR, **79**, 931 (1951).

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AUTOMATIC RECORDING OF CHANGES IN SURFACE TENSION BY THE MAXIMUM BUBBLE PRESSURE METHOD

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In the measurement of the surface tension σ of liquids by the maximum gas bubble pressure method the most difficult operation is to record the maximum height of the meniscus, corresponding to the detachment of the bubble¹. In the apparatus described here (Fig. 1) this operation is performed automatically. The cell for the measurement of σ is made of quartz, with the exception of the capillary and cap assembly, which is of Schott und Genossen glass. The test liquid is placed in vessel 1 and transferred by pressure of argon to the measuring vessel 2 until the probe 2a (which is 0.3 mm shorter than the capillary) just touches the liquid meniscus. The pressure of the gas bubble alters the height of the column in manometer 3.

The position of the meniscus in the manometer is recorded automatically by the following arrangement. Light from an OI-24 illuminator 4 passes through a solution coloured with a red dye and enters the optical system 5 of a KM-6 cathetometer.

When the pressure in the system is varied, the meniscus rises as the bubble grows, and the total illumination of the field of view of the objective of the cathetometer decreases.

Changes in illumination are monitored by the FEU-20 photomultiplier 8, supplied from a VS-22 high-voltage source 9. To make the electrical signal directly proportional to the displacement of the meniscus, a 0.2 mm wide vertical slit 6 was used. The slit was placed on the eyepiece in front of the photomultiplier so as to screen off the image of the meniscus except for a narrow central portion. At the instant of maximum pressure in the gas bubble, immediately before detachment, the illumination is a minimum: this corresponds to a minimum signal from the photoelectric multiplier. The signal from the multiplier 8 was measured with a U-1-2 d.c. amplifier and registered on an N-373 recording millivoltmeter 10. Since the fluctuations in brightness, and therefore also in potential, are very large, it was necessary to limit the peak voltages at

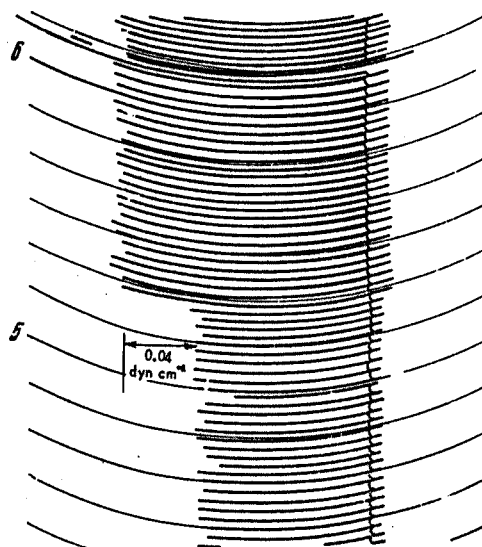


Fig. 2.

the maximum in order to use the 150 mV scale of the recorder. Peak voltages appear when the gas bubble detaches itself and the meniscus falls, causing a sharp increase in illumination in the field of view of the cathetometer. The maximum peaks were limited by a voltage-limiting diode 11, with a cut-off voltage controlled by biasing. The bias source was a U1199 high-stability rectifier. The entire apparatus was assembled on a massive steel block and placed in an air thermostat whose temperature was controlled with an accuracy of 0.1°.

Automatic recording enables changes in surface tension to be monitored at least down to 0.02 dyn cm⁻¹. A typical trace of the surface tension of water at 25°C is reproduced in Fig. 2. The discontinuity in the curve corresponds to a 0.1 mm displacement of the cathetometer, which is equivalent to 0.04 dyn cm⁻¹.

SUMMARY

An apparatus for automatic measurement of the surface tension of aqueous solutions of salts, acids, and organic compounds by the maximum bubble pressure method is described. It is particularly useful for studying relative changes in surface tension.

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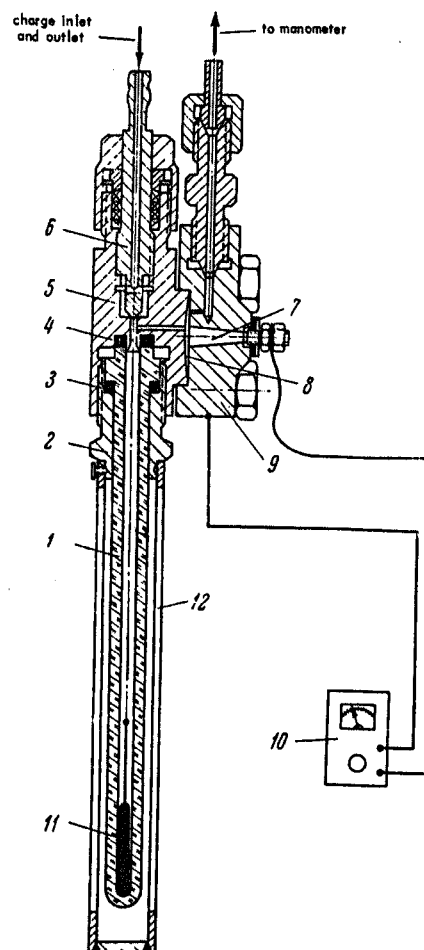
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APPARATUS FOR STUDYING THE PHASE AND VOLUME BEHAVIOUR OF BINARY SYSTEMS AT HIGH PRESSURES

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Phase equilibria at high pressures are studied, using the polythermal method¹, in two stages involving different apparatus. First, one determines visually, in sealed glass bulbs, the variation of the volume of the system with temperature along the saturation line, and then, with a different apparatus, one measures the pressure and determines the direction of the nodal lines joining the points for the volume and composition of the coexisting phases. The apparatus described here enables the two parts of the investigation to be combined in a single assembly.

The apparatus (see Figure) consists of three main parts: the bulb 1, the loading valve 6, and a miniature null-detector for pressure measurements. The glass high-pressure tube 1 is connected by the nut 2 and Teflon gaskets 3 and 4 to the sleeve 5 provided with the needle-valve 6. The design of this valve and of the bulb have been described earlier². The miniature null-detector for pressure measurement is based, like the one already described³, on the principle of a fully supported membrane able to withstand pressure differentials up to 100 atm without bursting.



The present null-detector differs from the previous one in not requiring a gland for the electrical leads. Whereas previous designs relied on a gland permitting longitudinal motion of the electrical leads in order to set the correct gap between the lead and the membrane, the present design dispenses with the gland. The membrane is always pressed against the electrical contact 7, whose position is fixed. To measure pressure, the membrane is merely forced apart from cone 7.

The sensing element of the null-detector is thus a membrane made of 1Kh18N9T [18/9 stainless] steel, 0.1 mm thick. The membrane is clamped between the flange 9 and the spherical surface machined on the sleeve 5, which form the working cavity of the null-detector and limit the displacement of the membrane when the pressure drops on either side of it.

The membrane divides this cavity into two mutually isolated parts. The left-hand side communicates with the bulb through an orifice of 0.5 mm diameter, and the right-hand side is connected to a manometer by tubing. The electrical lead 7, whose construction has been described³, is mounted flush with flange 9.