THE ACCOMMODATION COEFFICIENT OF MERCURY

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Submitted 18 September 1973
ZhETF Pis. Red. 18, No. 9, 557 – 560 (5 November 1973)

We measured the accommodation coefficient (α) of mercury on glass in the temperature interval 4.2 – 300°K, at a flux from 10^{13} to 5×10^{15} at/cm²sec. We have established that not more than 0.3% of the incident flux is reflected from the glass surface at 4.2°K.

To measure the accommodation coefficient of mercury on glass, we used the instrument shown in Fig. 1. The mercury in the evaporator (7) was heated with an oven (8) and kept at a constant temperature within ∿ 0.1°. The thermal shielding of the evaporator was with a foamed-plastic case (6). The temperature of the reflector (5) was controlled by an oven (3), and to improve the thermal contact with the thermocouple, mercury was poured into the vessel (4). The vessel was sealed on the top by a foamed-plastic stopper (1). The temperature in the interior of the vessel was automatically maintained constant with accuracy ∿ 0.3°.

During the course of its construction, the instrument was conditioned by evacuation with a diffusion oil pump at +400°C for four hours.

The ampule with the previously outgassed mercury was placed in a separate stub. After the end of the instrument conditioning, the ampule was broken with a magnetic striker and the necessary amount of mercury was redistilled into the instrument. The initial residual pressure in the sealed instrument did not exceed ∿ 10^{-} Torr and remained unchanged during the entire time of use of the instrument.

Using the same procedure as Volmer [1], the mercury flow was detected by using the change in the resistance of the mercury film condensed from the scattered flux on the surface of a

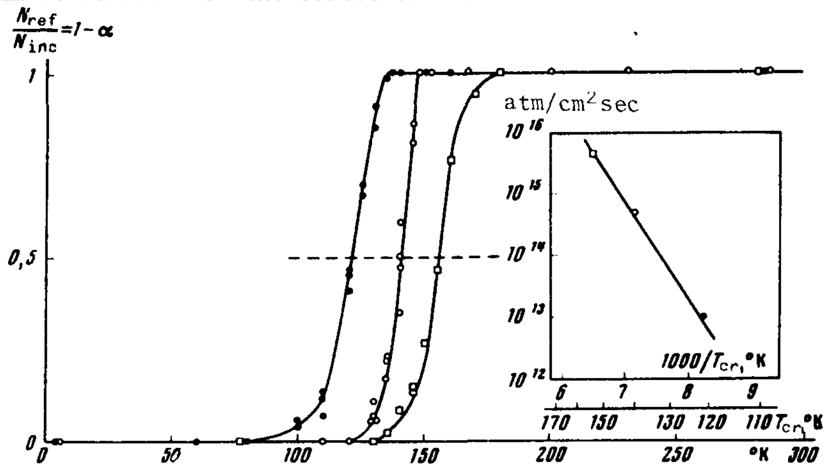

Fig. 2. Accommodation coefficient α vs the reflector temperature for different current densities: ● - 10^{13} at/cm²sec, ○ - 5×10^{14} at/cm²sec, □ - 5×10^{15} at/cm²sec. Dependence of the condensation temperature on the density of the incident flux.

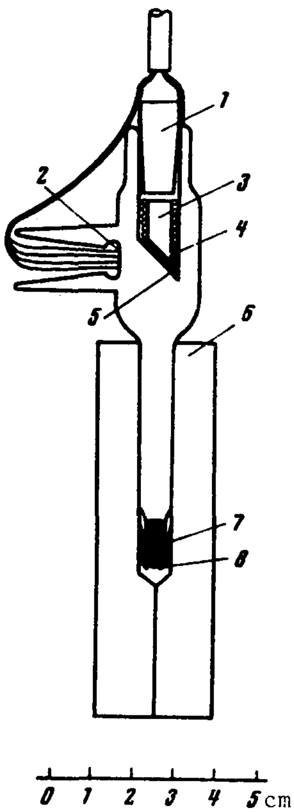

Fig. 1. Overall view of the instrument. The callouts are explained in the text.

receiver in the form of a sealed vessel (2) through the bottom of which four platinum electrodes passed, were ground flush, and were coated with a layer of molybdenum to protect them against the amalgamating properties of mercury. The entire instrument was immersed in liquid helium.

The experiment consisted of the following states:

1. The reflector temperature was set at 0°C (a temperature at which all the mercury atoms are fully reflected at the employed flux densities).

2. The evaporator heater was turned on, and after about ∿ 2 minutes the mercury temperature in the evaporator assumed the required value (T = 0 - +80°C).

3. The evaporator oven was turned off after a noticeable conductivity (R ∿ 10^8 ohm) appeared; the resistance variation ceased after ∿ 20 sec.

4. The reflector-surface temperature was set.

5. The evaporator heater was again turned on and the temperature raised to the working value and kept constant there for 3 – 5 minutes, after which the heater was again turned off. The dependence of the resistance on the time was plotted with the atuomatic recorder.

The R(t) dependence, which was investigated in detail in [2], was well reproducible under conditions of total particle reflection and had a sufficient rapid rise (from ∿ 10^6 Ω/atomic layer at R ∿ 10^7 Ω to ∿ 10^{-2} Ω/atomic layer at R ∿ 1 Ω). The character of the reflection of the mercury atoms from the glass surface was close to refuse, so that the R(t) plots obtained in the direct [2] and reflecting instruments (at α = 0) at the same flux density can be made congruent by changing the time scale by a factor 7 – 8. From the slopes of the curves obtained (a) under total-reflection conditions (T_{ref} = 0°C) and (b) under conditions of partial reflection (at the selected reflector temperature) determined the accommodation coefficient. The average attained accuracy was ∿ 3%.

To repeat the experiment, it was sufficient to heat the entire instrument, cooling only the stub containing the mercury, and to recondense all the mercury that had previously settled in the evaporator.

The results are shown in Fig. 2. The accommodation coefficient was estimated with particular care at 4.2°K, namely $(1 - \alpha) < 3\times10^{-3}$. The effective condensation temperature T_{cr} was arbitrarily chosen to be the temperature corresponding to reflection of 50% of the incident atoms. The figure shows also the dependence of T_{cr} on the intensity of the molecular beam incident on the surface. Naturally, the mercury already present on the reflector surface alters the accommodation coefficient. Thus, for example, if a thick mercury film (d_{eff} ∿ 1 μ) is condensed on the reflector surface, then we get $(1 - \alpha) < 0.01$ at $T \leq 180$°K. One should expect the critical temperature to become higher when the condensation time is increased.

[1] M. Volmer and J. Estermann, Zs. f. Phys. 8, 1 (1921).
[2] V. L. Tsymbalenko and A. I. Shal'nikov, Zh. Eksp. Teor. Fiz. 65, 2086 (1973) [Sov. Phys.-JETP 38, No. 5 (1974)].

SUPEREQUILIBRIUM UV RADIATION IN SELF-IGNITION OF A CS_2 + $4O_2$ MIXTURE AT ATOMSPHERIC PRESSURE

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Submitted 30 July 1973; resubmitted 21 September 1973
ZhETF Pis. Red. 18, No. 9, 560 – 563 (5 November 1973)

Anomalous emissivity was observed in self-ignition of a mixture of carbon disulfide with oxygen in the spectral band 350 – 420 nm. A mechanism explaining this effect is proposed on the basis of the kinetic features of the system.

Many spontaneous gas-chemical reactions are accompanied by nonequilibrium emission in the