

LABORATORY APPARATUS FOR THE STUDY OF ATMOSPHERIC CORROSION IN A CORROSIVE GAS DUCT

B. N. Rybakov and I. A. Efimov

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In examining the effect of corrosive gases on the atmospheric corrosion of metals [1-4], these gases are usually introduced intermittently into the reaction chamber, so that the kinetic data cannot always be definitely explained.

The apparatus suggested for a continuous feed of heavy corrosive gases into an air duct (see Fig. 1) comprises a system for blowing, purification, humidification (or drying) and control of the air flow rate A, a metering device for the corrosive gas B, a gas-air mixer C, and reaction vessel D (a desiccator). The air, forced by the electrical compressor 1 through the fore gas bottle 2, enters the CO₂ absorber [5] and passes on to humidification or drying [3] depending on the set task. The air consumption is regulated by the manostat 6 which is filled with the same solution as the humidifier and monitored by the flow meter 7. The heavy gas from the gas burette 8 enters the system uniformly at the required rate proportionately to the rise in the compensating vessel with mercury, which is attached by a cable to one of the coaxially connected pulleys of different diameter 9 rotated by clockwork.*

The gas concentration in the mixture may be varied over a wide range, first of all by means of replaceable calibrated tubes in the gas burette and, secondly, by using pulleys 9 of different diameter. The concentration in the mixture is determined by the volumetric blow rate (speed) of the air and the rate of supply of corrosive gas to the system and is calculated from the formula [6, 7]

$$A = \frac{\pi \omega r^2 R}{V}, \quad (1)$$

*For the purpose indicated it is best to use a weekly wind clockwork from weekly thermographs or barographs.

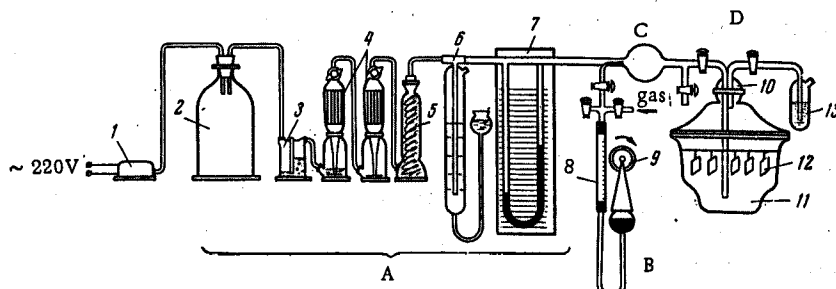


Fig. 1. Diagram of apparatus for studying atmospheric corrosion in a duct of corrosive gases. 1) Microcompressor; 2) fore gas bottle; 3) Tishchenko bottle with 20% KOH solution (CO₂ absorber); 4) humidifier (dryer); 5) mist absorber; 6) manostat; 7) flow meter; 8) gas burette; 9) pulleys; 10) sampler for gas-air mixture; 11) desiccator; 12) specimens; 13) water seal.

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in which A is the volumetric concentration of the gas introduced, %; V is volumetric blow rate of air expended, $\text{cm}^3 \cdot \text{sec}^{-1}$; ω is the angular speed of the clockwork, sec^{-1} ; r and R are the radii of the burette and the pulleys, cm.

So that, at a low feed rate, the gas does not enter the system by diffusion, it is brought in through a capillary tube, the diameter and length of which are calculated from the inequality (Eq. 2) recommended in [7]:

$$\frac{r^2 R \omega l \sigma}{r_1^2 D} > 1, \quad (2)$$

where l is the capillary tube length, cm; σ is the coefficient of local resistance of the gas at the capillary outlet; r_1 is the capillary diameter, cm; D is the gas diffusion coefficient, $\text{cm}^2 \cdot \text{sec}^{-1}$. Thus, to obtain a mixture in the apparatus with an SO_2 concentration of 0.001%, the capillary should not be less than 10 mm long and not more than 0.15 mm in diameter.

The burette 8 is filled with gas through a side branch with a tap and flushed with it several times, after which it is ready for operation. Before each fresh series of experiments the gas-air mixture is passed through the desiccator in an amount sufficient to change it five times. When carrying out the tests in a building with small temperature fluctuations temperature control of the apparatus is unnecessary. Otherwise, the whole apparatus is placed in an air thermostat. The results of an experimental check, carried out by acidimetric titration of the SO_2 absorbed from the gas-air mixture [8], indicated that the mean square error in the concentration calculated theoretically from Eq. (1), from ten measurements is $\pm 5\%$. In prolonged tests (over 20 days) as found by special experiments, the fluctuations in the corrosive gas concentration do not exceed $\pm 10\%$.

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