This allows us to conclude that in glasses of the system $V_2O_5$-$V_2O_4$-$P_2O_5$ there exist simultaneously two types of conductivity: electronic and puncture. Under these conditions, in those cases when the glass contains excess $V_2O_5$ and the $V_4O_4$ is contained as an impurity, it should possess an electronic character of conductivity, and in the opposite case, the puncture type.

Considering the mechanism of electroconductivity of vanadium glasses, it would be possible to assume that the curve for "specific electric conductivity - composition" should have a maximum at a molar ratio of $V_2O_5$: $V_2O_4$ near to 1.

However, Fig. 1 shows that this maximum appears at a molar ratio of about 8. This shows that the $V_2O_4$ in the glass, in the presence of the impurity $V_2O_5$, ensures a lower specific electric conductivity than $V_2O_5$ with $V_2O_4$ as impurity.

Apparently, the tendency to polymerization of semiconducting oxides introduced into its composition considerably influences the specific conductivity of acidic semiconducting glasses. Indeed, the $V^{4+}$ ion has a larger radius and lower charge than the $V^{5+}$ ion. According to the proposition of Sun [8] this is due to the lower tendency of $V_2O_5$ to polymerization, in comparison with $V_2O_4$. Therefore if the $V^{5+}$ ion appears as a glass former, then the ion $V^{4+}$ in its role in the structure of the glass should be near to a modifier. A similar position of the ions in the glass should lead to a great upset and difficulty in interchanging the charges.

The secondary increase in the specific electric conductivity of the glasses with increase in the $V_2O_4$ from 17.77 to 23.60% may be explained by the significant quantitative change in structure of the glass toward ordering of it, and to the start of crystallization. This is proved by the anomalous growth in energy of activation in glasses with a $V_2O_4$ content of more than 19% (see Fig. 2) and the results of the x-ray structural analysis showing the presence of a crystalline phase in the glass containing 23.60% $V_2O_4$.

**LITERATURE CITED**


**THE INFLUENCE OF THE COMPOSITION OF ACID BATHS ON THE STRENGTH OF PLATE GLASS**

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Acid baths consisting of hydrofluoric acid or mixtures of HF with sulfuric acid are used for the chemical treatment of glass with the aim of increasing its mechanical strength and to obtain brilliant surfaces. As is well known, the rate of reaction between the glass and the hydrofluoric acid increases with concentration. Data on the etching rate of glass in mixtures of hydrofluoric and sulfuric acid are scarce in the literature. A special study was made to remedy this.

*See C. B. translation.
Experiments were made with glasses from the Konstantinovsk "Avtosteklo" factory, cut in the form of squares with sides 90 mm in length. The rate of etching was established, by the gravimetric method, from the amount of dissolved glass per unit of surface. Results of the tests, etching for 15 minutes on glass made by vertical drawing, are shown in Fig. 1.

These graphs show that by using HF with a concentration of more than 0.5 N the maximum rate of etching is observed with a sulfuric acid concentration of 6N or 12N, and the minimum rate with a concentration of about 18N.

The same rules are observed for the etching of glasses made by direct rolling and high-zircon glasses which are different in chemical composition from vertically drawn glass. Consequently, the etching rate depends not only on the chemical composition of the glass, but also on the processes taking place in the etching baths.

With the gradual addition of sulfuric acid to the hydrofluoric acid, the removal of the glass (by etching) sharply increases, owing to the conversion of the fluorides to the more soluble sulfates. The salts thus formed are quite easily removed from the glass surface, and this allows easy access of the reagents to the glass. With a sulfuric acid concentration of from 6N to 12N, the first maximum point in the glass-etching cycle is observed. Then the degree of etching diminishes, apparently owing to the hydration changes in the solution caused by the sulfuric acid. Having attained a minimum, situated between a H2SO4 concentration of 12 and 18N, the glass removal again suddenly diminishes, as a result of the formation in the bath of fluorosulfonic acid, which also facilitates the conversion of the low-soluble salts in the bath to more soluble compounds. Reaching the second maximum at a concentration of 24N H2SO4, the rate of reaction again drops sharply, owing to the sudden reduction in the quantity of free fluorine ions bonded in the fluorosulfonic complex.

Furthermore, the processes occurring during etching are probably affected by the ions of HF2+ which may form upon contact of HF with strong sulfuric acid.

It should be noted that at high etching rates and the appropriate concentrations of sulfuric acid of 6N and 24N, the quality of the glass surface is much better than with low rates (18N H2SO4), when the etching process occurs irregularly and a large number of deep craters form on the glass.

A range of experiments showed the effect of composition and concentration of the different acid baths on the strength of the glass. For each one of such experiments, about 20 square specimens of polished glass 5-6 mm thick were used. A layer 0.1 mm thick was removed from the glass surface by etching. The temperature of the acid baths was 26±2°C.

The mechanical strength of the glass in these and all subsequent trials was determined by the symmetrical-bend (central) method. Specimens were placed on a rounded support 80 mm in diameter, and the destroying load was applied from above at concentric circle positions (the circle having a diameter of 14 mm).