resistance were obtained when a coating of the following initial composition (%) was used: 81 ± 3 ZrSiO₄ and 19 ± 3 P₂O₅.

The presence of crystal phases was determined using x-ray analysis on a DRON-2.0 diffraction meter (CuKα radiation). There are four clearly expressed maxima belonging to the crystal phases which can be identified as zircon and zirconium pyrophosphate in the x-ray patterns of the zircon phosphate coating. The relative change in the amount of zirconium pyrophosphate was evaluated from the most intense x-ray lines (200), (311), and (220) with the corresponding interplanar spacings of 4.12; 2.49; and 2.92.

The x-ray phase analysis showed that with an increase in the concentration of P₂O₅ in the original material, the amount of zirconium pyrophosphate in the coating increases after heat treatment. In this case the strength of the zircon phosphate material increases. Thus, the compressive strength of specimens with a concentration of 20% of ZrP₂O₇ was 30 MPa. For specimens with a 10% concentration of ZrP₂O₇ the compressive strength is significantly lower: 7-9 MPa.

It is established that the greatest formation of zirconium pyrophosphate occurs at 1273-1423°K.

During prolonged heat treatment at 1420-1520°K there is a redistribution of the concentration of P₂O₅ in the coating. The amount of zirconium pyrophosphate is reduced in the surface layer of the coating, but in the internal layer touching the surface of the vitreous silica it increases.

With further heat treatment, a sitall-like structure based on cristobalite forms under the layer of coating, and on the x-ray pattern of the original coating the pyrophosphate peaks disappear and only the zircon peaks remain. Using petrography we established a glass phase which is identified as glassy silicophosphate in the sitall-like structure.

The use of the results of the reported studies has made it possible to optimize the production process of applying zircon phosphate coatings to articles made of vitreous silica to be used in the semiconductor industry.

LITERATURE CITED
1. USSR Inventor's Cert. Nos. 1038306 and 1010032.

READSORPTION BY SYNTHETIC SILICA

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Synthetic silicon dioxide (SSD) is a good sorbent and after heat treatment at low temperatures (up to 400°C) is used as an adsorbent and drying agent. The adsorption capacity of synthetic silica is affected by the quality of the raw quartz material and is determined by the conditions of the preliminary heat treatment and storage of a given product. Therefore, a study of the processes of readsorption as a function of the heat treatment of SSD makes it possible to control the conditions of transportation and storage of the material.

The process of readsorption and rehydroxylation of synthetic silicon dioxide was studied in [1] using a gas chromatography method on specimens of SSD previously heat-treated to 750°C in accordance with TU [Tech. Spec.] 6-09-19-94-75 (type I SSD) and to 1150°C in accordance with TU [Tech. Spec.] 6-09-19-95-75 (type I SSD) and to 1150°C in accordance with TU 6-09-50-16-82 (type SSD) before and after storage for 10, 50, 100, and 150 days at a relative humidity of 100%. In the preliminary heat treatment of the SSD to 750°C there is a decrease in the physically adsorbed gas components in the 20-300°C interval, and then at higher temperature the hydroxyl cover is removed.

With a fairly short storage period over water, the hydroxyl cover is virtually not restored [2]. The surface of the SSD is passive [3]. In this case the adsorption processes are quite weakly expressed since the adsorption only occurs at the OH groups which remain


Fig. 1. Dependence on the experimental temperature, t, of the amount of gas impurity, \( \Delta W_t \), liberated from SSD type I (a) and II (b) before (1) and after (2) storage for 150 days.

As a result of insufficiently careful heat treatment of the SSD to 750°C. Therefore during storage of type I SSD specimens over 10 days at a relative humidity of 100%, the total concentration of gas components mainly removed from the surface of the specimen at up to 300°C, increases slightly (it doubles). The amount of gas impurities observed at temperatures over 300°C (up to 1200°C) remains virtually the same as before the storage of the SSD specimens.

In the storage of the type II specimens of SSD it was established that readsorption by the surface of the SSD is even less marked and the total concentration of gas impurities increases 1.3-fold with storage. A reduction in the level of rehydroxylation and rehydration of the SSD after preliminary heat treatment at 1150°C is caused by the decrease in the active surface since less than 1.5% of OH groups remain on the surface of the silica gel by comparison with the extreme hydroxylated state [2]. The value of the specific surface of all the experimental specimens of this series remains constant and does not change during the rehydroxylation of the surface of the SSD.

Figure 1 shows the results of a study of the processes of readsorption of \( \text{CO}_2 \) and \( \text{H}_2\text{O} \) and the rehydroxylation of SSD specimens after storage. It was established that the concentration of \( \text{CO}_2 \) decreases with the storage of the SSD which had been treated in advance at 750°C. This can be explained by the presence of Si-OC\( _2\text{H}_5 \) bonds as a result of the incomplete hydrolysis of the tetraethoxysilane (Si(OC\( _2\text{H}_5 \))\(_4\)) in the process of obtaining the SSD. The -C\( _2\text{H}_5 \) radical may remain on the surface of the specimen due to insufficiently careful heat treatment of the SSD at low temperatures (up to 300°C). In this case there is an insufficiently complete removal of the residual organic components.

The Si-OC\( _2\text{H}_5 \) bonds are capable of being hydrolyzed in contact with water. In this case a molecule of \( \text{C}_2\text{H}_5\text{OH} \) is formed and leaves the surface of the specimen at temperatures below 100°C. Further burning off of the organic components proceeds with the formation of \( \text{CO}_2 \); this process clearly prevails over the adsorption of \( \text{CO}_2 \) by the surface of SSD.

As a result of the storage of type II SSD, no decrease is observed in the concentration of \( \text{CO}_2 \), i.e., the SSD heat-treated in accordance with TU 6-09-50-16-82 up to 1150°C contains no residual organic radicals capable of being hydrolyzed.

When types I and II SSD are stored for 150 days, there is an increase in the content of physically bonded and chemisorbed water. The amount of physically sorbed water increases