THERMOLYSIS OF COMPOSITES BASED ON POLYANTIMONIC ACID CONTAINING Nb^{5+} IONS

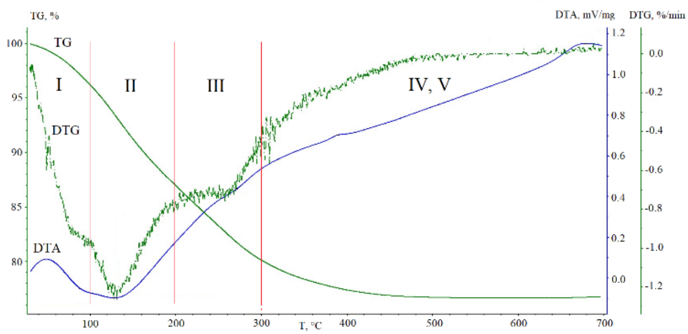
Kovalenko L.Yu., Zakhar'evich D.A., Burmistrov V.A.
Chelyabinsk State University
454001, Chelyabinsk, Bratiev Kashirinykh st., 129

Particles of solid acids are introduced into the membranes of hydrogen-air fuel cells to increase their moisture capacity. Promising components include pyrochlore-type structure polyantimonic acid (PAA), amorphous niobium acid (NA), and composites based on them.

The purpose of this work was to determine the stages of thermolysis of PAA-based samples, containing Nb^{5+} ions.

The samples were synthesized using the co-precipitation method. Starting reagents: $SbCl_3$ (pre-oxidized to Sb^{5+}), $NbCl_5$. Samples were characterized by X-ray powder diffraction on DRON-3M and Rigaku Ultima IV diffractometers. The proton-conducting properties were studied using an Elins-Z1000J impedance meter in the frequency range from 1 Hz to 2 MHz, at a temperature of 25°C and a relative humidity of 58%. The thermal properties of the samples were studied in air using a Netzsch STA 449F5 Jupiter simultaneous thermal analysis system.

According to the data of X-ray phase analysis, the maximum concentration solid solution of substitution has the composition $H_2Sb_{1.6}Nb_{0.4}O_6 \cdot nH_2O$, $n \geq 1$, within the framework of the pyrochlore-type structure; the conductivity value is $5.0 \cdot 10^{-3}$ S/m. The highest conductivity values among the considered acids are exhibited by $H_2Sb_{1.4}Nb_{0.6}O_6 \cdot nH_2O$, $n \geq 1$, a composites based on PAA; the conductivity value is $11.5 \cdot 10^{-3}$ S/m. In contrast to PAA compositions, x=0, x=0.4, the DTG curve of the x=0.6 sample can be divided into stages I and II (Fig.).



Thermogravimetry (TG), derivative thermogravimetry (DTG), and differential thermal analysis (DTA) for the $H_2Sb_{1.4}Nb_{0.6}O_6 \cdot nH_2O$

In the composition x=0.6, proton-containing groups are removed in 3 stages: stage I: 0.85 H_2O (up to 100 °C); stage II: 2.00 H_2O (up to 200 °C); stage III: 1.50 H_2O (up to 300 °C); stage IV-V: 0.50 H_2O (up to 450 °C). A possible reason for the higher conductivity value is the non-equivalence of proton-containing groups.