SEAE 40P CATALYST OF OXYGEN ELECTRODE OF FUEL CELL ON THE BASIS OF VANADIUM PENTOXIDE

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Using electrochemical combustion catalysts containing no noble metals and their alloys is very promising. By means of sol-gel technology we obtained catalysts of oxygen electrode of fuel cell on the basis of V_2O_5.

We obtained vanadium pentoxide sols by hydrolysis of vanadium triisopyroxide $VO(OC_3H_7)$ for that 2 cm^3, containing 100 cm^3 H_2O. When contacting the two fluids immediately form red gel. The gels were dispersed using a magnetic stirrer. As a result we obtained dark red homogeneous solution. Complex solutions of the polymer electrolyte were prepared by dissolving polyethylene oxide (PEO), relative molecular weight- $5 \cdot 10^6$) and orthomethanesulphonate in distilled water so as to obtain 2% solutions PEO- $LiCF_3SO_3$. Colloidal polypropyrrol solutions (PP) were obtained by oxidation of pyrrol with ferrous chloride ($FeCl_3$).

Next we performed mixing in order to get homogeneity and dispersion of the mixture.
The procedure was performed as follows: 1. Vanadium oxide PEO. Vanadium oxide colloidal solution (50 cm^3) was added to a 2% aqueous solution (10 cm^3) PEO- $LiCF_3SO_3$ drop by drop, under vigorous stirring till getting a homogeneous viscous solution. 2. Vanadium oxide - PEO- PP. PP 2% solution was added to a 2% aqueous solution of PEO- $LiCF_3SO_3$ drop by drop with stirring, and then vanadium oxide solution in the same manner. The resulting films were examined by X-ray diffraction and electron microscopy. The examination results showed homogeneity of the films and absence of any evolved entities. Transmission electron microscopy demonstrated that the vanadium oxide gels have a structure comprising interlacing ribbon-shaped fibers with thickness $-15 \cdot 10^{-6}$ m. From X-ray diffraction studies we established that the dashed lines at the X-rays correspond (interplanar distances -d) V_2O_5 and have preferential directions (perpendicular supports).

Then we coated the pressed nickel electrodes with the obtained composites by casting method and dried them in vacuum oven (P ~10 mm Hg) at the T=393°, and then held at the T=773 ° during an hour.

The obtained electrodes were examined in an ordinary electrochemical glass cell, where the decay rate of H_2O_2 was determined and polarization curves were taken, in accordance with which electrode activity was estimated.

It was demonstrated that use of sol-gel technology allows increasing electrode activity by 15-20%. The obtained results were explained basing on "the hole-complex" theory.

Oxygen marked * is active oxygen. Hole transition can be carried out according to the following schedule:

$$Li_2O+V_2O_5 \leftarrow\rightarrow 2[Li\text{-}O^*\text{-}V^{4+}\text{-}V^{4+}\text{-}O^*\text{-}Li]$$
$$\begin{matrix} \| & \| \\ O & O \end{matrix}$$

$$O^- (2p^5) + V^{5+} (3d^0) \leftarrow\rightarrow O^{2-} (2p^6) + V^{4+} (3d^1)$$

$$O^{2-} (2p^6) + V^{4+} (3d^1) \leftarrow\rightarrow O^- (2p^5) + V^{5+} (3d^0)$$