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THE SPECIFICITY OF THE INTERACTION OF PALLADIUM WITH HYDROGEN

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My research work is aimed at conducting experiments and studying the behavior of materials in different conditions, which will help in solving problems with storage and obtaining hydrogen.

MATERIALS AND METHODOLOGY OF THE EXPERIMENT

A cantilever was installed in the hydrogen-vacuum installation, and one end was fixed in a holder so that the side of the cantilever was on top, which is covered with a copper film that does not allow hydrogen to pass through and does not affect the shape of the cantilever change. Next, the hydrogen pressure in the chamber was raised to the specified value and hydrogen saturation was carried out on one side of the cantilever made of pure palladium (99.99%), as a result, an α-PdHn alloy was obtained. After that, this alloy was kept in a hydrogen environment to equalize the hydrogen concentration along the cross section of the cantilever and to reduce the hydrogen-concentration stresses. As a result of such experiments, alloys with different hydrogen content from n= 0.0184H/Pd to 0.0062 H/Pd were obtained.

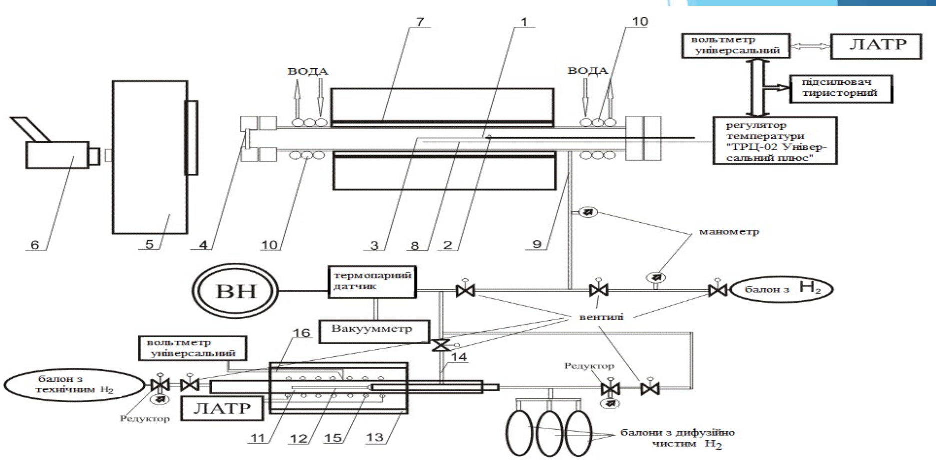
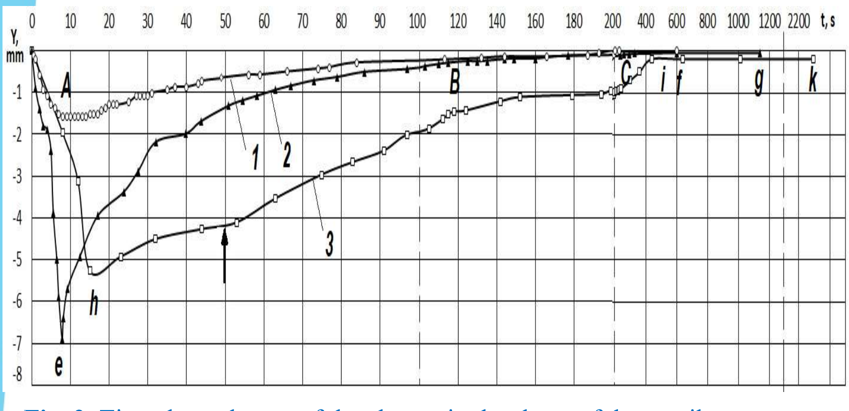


Fig. 1. The working chamber of the hydrogen-vacuum installation (HVI) and its connection with other units: 1 – sample; 2 – holder; 3 – free end of the sample; 4 – window; 5 – cathetometer; 6 – video camera; 7 – electric stove; 8 – chromel-alumel thermocouple; 9 – nozzle; 10 – refrigerators; 11 – palladium filter chamber; 12 – diffusion element; 13 – palladium filter camera body; 14 – nozzle for collecting waste gas; 15 – electric stove; 16 – chromel-alumel thermocouple.



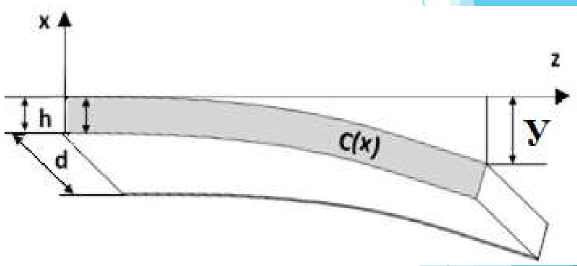


Fig. 4. Scheme of bending of a palladium plate, where d is the width of the plate; l - plate length; h - plate thickness ; c(x) – concentration; μ - deviation of the plate

Fig. 2. Time dependences of the change in the shape of the cantilever at a temperature of 240°C during the degassing process: at a hydrogen pressure of 0.03 MPa for the alloys α-$PdH_{0.0105}$ (1); at a hydrogen pressure of 0.3 MPa for the alloys α-$PdH_{0.0464}$: (2) – degassing time 5.59 s; (3) – degassing time 49.77 s.

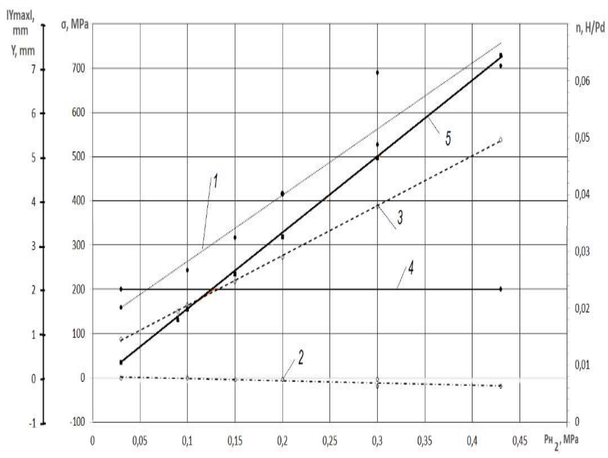


Fig. 3. The effect of hydrogen pressure on the maximum bending (1) and residual stationary bending (2) of the α-PdHn alloy cantilever; on internal stresses (3) when the concentration changes (5) at 240 °C; elastic limit (4).

CONCLUSIONS

1. First, is installed, so when changing the vice to ΔP_{H2} = 0.03; 0.1; 0.15; 0.2; 0.3; 0.43 MPa value of the maximum values:- for the cantilever it increases from - 1.6 to - 7.05 mm, and the blades are almost completely reversed;- stage of rotation of the plate α-$PdH_{0.0105}$; α-$PdH_{0.0198}$; α-$PdH_{0.026}$; α-$PdH_{0.0326}$; α-$PdH_{0.0464}$; α-$PdH_{0.0644}$ as the hour of degassation increases due to the increasing pressure of hydrogen, and with a value of P_{n2} = 0.3 MPa and plate width ~ 7 mm, the width appears to be almost completely reversible (0.04 mm);
2. It has been established that at a temperature of 240˚C during degassing of the cantilever with stop α-PdHn, the vibration develops in two different hourly stages.
3. The shape change of the cantilever with stop α-PdHn is associated with the laws of the process of degassing and diffusion of hydrogen from metal in the minds of the experiment.