foam, determined by the standard method, is the greatest, approximately twice as stable as the foam of KhOSP-10.

Therefore, KhOSP-10, KhOSP-A, and KhOSP-N inhibitors provide the necessary protection of steel from acid corrosion at high temperatures (100, 120, 140, and 160°C) and pressure (30 MPa). Especially effective in this sense is KhOSP-N inhibitor, the degree of protection of which is 88% at 160°C. The inhibitors KhOSP-N and KhOSP-A are also characterized by intense foam formation and the stability of their foams is approximately double that of KhOSP-10 inhibitor. As the result of the good protective capacity of KhOSP-A and KhOSP-N acid corrosion inhibitors at high temperatures and pressures and also their active foam formation they are promising for acid treatments of the strata of oil and gas wells and for increasing their productivity.

LITERATURE CITED

HIGH-TEMPERATURE SALT CORROSION CRACKING OF TITANIUM ALLOY SEMI-FINISHED PRODUCTS*

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High-temperature salt corrosion cracking (HTSCC) of titanium alloys appears under the action of applied stresses and high temperatures (260-500°C) and in the presence of sodium chloride on the surface [1-4]. In the opinion of a number of investigators the presence of oxygen and moisture is also a necessary condition for this form of corrosion cracking. In addition to sodium chloride other salts create the conditions for the occurrence of HTSCC of titanium alloys although not to such a degree.

Of the halogenides, sodium and lithium salts are the most active. In addition, bromides and iodides may cause HTSCC [2, 5]. The corrosion mechanism of titanium alloys has not been accurately established; the reactions occurring have not been clearly determined. An important role in corrosion cracking is played by the intermediate reaction products HCl, Cl₂, TiCl₄, and hydrogen, which, adsorbed on the metal, embritties the alloy and is assumed to be responsible for salt corrosion [2, 6, 7]. The correctness of this concept is confirmed by local accumulation of hydrogen on the surface of failed samples. The influence of aluminum on the HTSCC of titanium alloys is indirect evidence of the mechanism of hydrogen em-

*The experimental portion of the work was done by V. E. Belousova, R. F. Tashlanova, and V. V. Popova.

Fig. 1. Influence of applied stress on the time until failure of samples prepared from hot-rolled titanium and titanium alloy plates: solid line) with salt coating; broken line) without coating; 1) VT20, 400°C; 2, 2') VT20, 500°C; 3, 3') VT6, 500°C; 4, 4') VT1-0, 500°C; 5, 5') OT4-1, 500°C; 6, 6') VT14, 500°C.

Fig. 2. Influence of stress on the time until failure of samples prepared from hot-rolled VT20 alloy bars: solid lines) with salt coating; broken lines) without coating; 1, 1') hot-rolled condition, T_{test} = 400°C; 2, 2') annealed condition (800°C), T_{test} = 500°C; 3, 3') hot-rolled condition, T_{test} = 500°C; 4, 4'), double annealed (800 and 450°C), T_{test} = 500°C.

Fig. 3. Anisotropy of corrosion properties in HTSCC testing of samples prepared from hot-rolled plates: 1, 3) transverse and longitudinal samples of VT20 alloy; 2, 4) transverse and longitudinal samples of VT6 alloy.

Brittlement. The reason for the increased sensitivity of Ti-Al system titanium alloys to HTSCC is not only the special predisposition of aluminum to corrosion but also the fact that aluminum reduces the solution of hydrogen, promoting the formation of brittle hydrides [7, 8].

At present significant experimental material has been accumulated on the HTSCC of foreign and domestic titanium alloys. However, information relative to the influence of the form of semifinished product, the anisotropy of the corrosion-mechanical properties, and heat treatment on the resistance of the alloys to HTSCC is quite limited [6, 7-10].

This work is devoted to a study of the HTSCC of titanium alloy semifinished products in the form of hot-rolled plates and bars. The investigated materials were VT-20 pseudo-α-alloy and VT6 and VT14 α + β-alloys and a comparison was made with technical purity titanium and OT4-1 low-alloy α-alloy. The experiments were made on ZST-3/3 and YaMB-2 machines with a constant load at 400 and 500°C with different levels of stresses, 0.4, 0.5, 0.75, and 0.9% of the test base was not less than 100 h. The tests were made on standard round tensile samples with an NaCl salt coating (0.2-0.3 mg/cm²) cut from hot-rolled bars in the rolling direction and from hot-rolled plates parallel and perpendicular to the rolling direction. The sensitivity of titanium alloy semifinished products to HTSCC was determined by the time until failure of samples with a salt coating and without it. The loss of mechanical properties as the result of HTSCC was determined on samples which did not fail in 100 h.