In the present work, we increased the corrosion resistance of the boron–aluminum composite by cladding with an aluminum or titanium foil and then coating the edges with reinforcing lacquer. The use of titanium foil increased the service life of the composite in seawater by several orders of magnitude and simultaneously simplified the pressing technology.

LITERATURE CITED

1. J. M. Evans and D. M. Breddick, Corros. Sci., 11, 611 (1971).
2. A. J. Sedricks, J. A. S. Green, and D. L. Novak, Metall. Trans., 2, 871 (1971).

VARIATION IN THE PROPORTION OF OXYGEN DEPOLARIZATION AS A RESULT OF THE USE OF ACID-CORROSION INHIBITORS

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The addition of inhibitors is very often accompanied by an increase in the proportion of oxygen depolarization in the overall cathode reaction causing corrosion (hydrogen evolution and oxygen reduction) [1-3] from Δ_O to Δ_O':

$$\Delta_O = \frac{i_O}{i_O + i_H} = \frac{i_O}{i_{cor}}; \quad \Delta_{O'} = \frac{i_O}{i_O + i_{H'}} = \frac{i_O}{i_{cor'}}.$$

This is usually ascribed to the fact that organic inhibitors have a greater effect on the kinetically controlled evolution of hydrogen than on the diffusion-limited electrochemical reduction of dissolved oxygen [4,5]. This explanation can be regarded as self-evident when the only process influenced by the inhibitor is the cathodic evolution of hydrogen. On plotting the corresponding polarization curves, it is easy to see that the addition of inhibitors in this case decreases the rate of corrosion, shifts the corrosion potential in the negative direction, and increases the proportion of oxygen depolarization. As can be seen from Fig. 1, however, an increase in the proportion of oxygen depolarization should also be observed when the inhibitor acts only on the anodic dissolution of the metal. The corrosion rate decreases in this case too (from i_{cor} to $i_{cor'}$), but the corrosion potential is shifted in the positive direction. Clearly, if the inhibitor suppresses both cathodic hydrogen evolution and anodic metal dissolution, i.e., acts on both reactions, the proportion of oxygen depolarization must increase in this case too. Depending on the relative influence of the inhibitor on the partial electrode reactions, the corrosion potential may either be shifted in one direction or the other or remain unchanged.

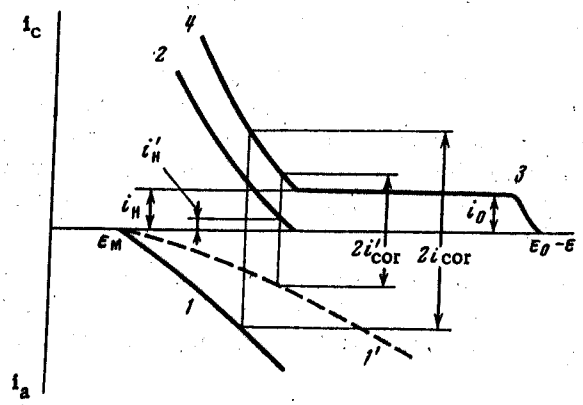

Fig. 1. The change in the corrosion process on adding an inhibitor which retards only anodic metal dissolution. Polarization curves: 1) metal dissolution; 1') metal dissolution in the presence of inhibitor; 2) hydrogen evolution; 3) oxygen reduction; 4) sum of the two cathodic processes. The other symbols are defined in the text.

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In other words, all inhibitors whose action does not amount exclusively to mechanical shielding of the surface must increase the proportion of oxygen depolarization.* Even inhibitors which act only by a blocking mechanism will increase the proportion of oxygen depolarization provided that the surface coverage is not too great [6, 7]. Thus, an increase in the proportion of oxygen depolarization is a natural consequence of the use of corrosion inhibitors in aqueous (acid) media.

LITERATURE CITED

1. L. P. Anoshchenko, Tr. Novocherkassk. Politekh. Inst., 25/39, 43 (1954).
2. L. P. Anoshchenko, Corrosion Inhibitors [in Russian], Vol. 2, MGPI im. V. I. Lenina (1957), p. 45.
3. N. L. Podobaev and F. N. Kurbanov, Teploenergetika, 4, 73 (1964).
4. L. I. Antropov, Zashch. Met., 2, 279 (1966).
5. L. I. Antropov and I. S. Pogrebova, Results of Science and Technology, Corrosion and Protection from Corrosion [in Russian], Vol. 2, VINITI, Moscow (1973), p. 27.
6. L. I. Antropov and M. A. Marinich, Elektrokhimiya, 14 (1978).
7. L. I. Antropov, Zashch. Met., 13, 387 (1977).

PASSIVATING PROPERTIES OF SODIUM NITRITE

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In spite of the fact that sodium nitrite is widely used as a corrosion inhibitor, the pH range in which it is capable of passivating steel has not yet been determined. It remains an open question whether the nitrite ions themselves inhibit the ionization of the metal by being adsorbed on its surface or whether they are reduced at the corrosion potential and assist only indirectly in the formation of a higher-valence passivating oxide phase on the steel.

In the present work, we have studied the inhibiting properties of nitrite ions on steel in a buffer electrolyte as a function of the pH and the sodium nitrite concentration. In order to study the direct offset of the hydrogen ion concentration without changing the anionic composition of the electrolyte, we used a phosphate–borate buffer and varied the pH of the electrolyte by adding NaOH.

In accordance with the results of other authors [1, 2], the passivation potential of steel in pure buffer electrolytes is shifted in the negative direction as the pH of the solution increases: from +1.1 V at pH = 2 to −0.28 V at pH = 7. The critical passivation current decreases accordingly from $3 \cdot 10^{-2}$ to $1.2 \cdot 10^{-4}$ A/cm^2.

On adding sodium nitrite (0.01 N) to the buffer electrolytes, we observe the same behavior as in the pure buffer electrolytes, but both the potential and critical current of steel passivation decrease regularly with increasing sodium nitrite concentration at constant pH (Fig. 1). The change in passivation potential of metals under the influence of oxidants has also been noted in [3, 4].

As one of us has shown [5], nitrite ions are not reduced on steel in neutral electrolytes, which means that the possibility of passivation due to nitrite reduction currents is ruled out, so we must assume that nitrite ions are indirectly involved in the passivation process. Adsorption of nitrite ions on the surface of iron decreases the free energy of the system and thereby inhibits the transfer of metal ion–atoms from the lattice into solution. It is most probable that adsorption takes place on the most active sites and thus greatly decreases the rate of metal dissolution.

*An exception may be inhibitors which facilitate cathodic hydrogen evolution while at the same time inhibiting anodic metal dissolution to a greater extent.

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