Inhibition of steel corrosion by, Co(II), Zn diphosphates

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In actual practice of technological processes intensification in chemical, machine-building and metallurgical industry the special attention is devoted to questions of anticorrosive protection of metals and equipment. The aim of this work was to investigate the anticorrosive properties of new Mn(II), Co(II), Zn diphosphates solid solutions. $Mn_{2-x}Co_xP_2O_7 \cdot 5H_2O$ ($0 < x \leq 0.83$) and $Mn_{2-x}Zn_xP_2O_7 \cdot 5H_2O$ ($0 < x < 2.00$) solid solutions obtained as described in [1]. Corrosion researches of steel 08kp samples were conducted by the technique described in [2]. We used $5 \cdot 10^{-3}$ mole/l H_2SO_4 solution (background) as the model corrosion environment. Concentration of diphosphates in solution was $5 \cdot 10^{-3}$ mole/l. The gravimetric corrosion researches have shown that the addition of diphosphates to the background solution provided the reduction of steel corrosion rate in 2.5–3.5 times that corresponded to protection degree of 59–70 %.

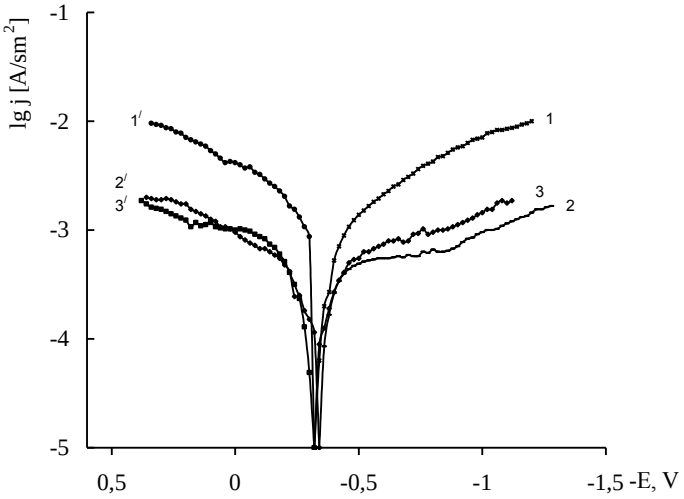

Fig. -Polarization dependence obtained on steel 08 kp in 5 $\cdot 10^{-3}$ mole / l solution H_2SO_4 without additives (1.1 /) and with the addition of diphosphates $Mn_{0,74}Zn_{1,26}P_2O_7 \cdot 5H_2O$ (2,2′); $Mn_{1,17}Co_{0,83}P_2O_7 \cdot 6H_2O$ (3,3′)

The results of electrochemical researches showed that the largest corrosion currents were observed in the background H_2SO_4 solution (Figure). The addition of diphosphates into the acid solution significantly altered the shape of polarization curves. Anodic current density in the presence of diphosphates was reduced almost on the order of magnitude, in comparison with a current density in the background solution, throughout the region of potentials under study. Thus, at the potential –0.18 V the value of current density logarithm in case of background solution was –2.64 and it was reduced in the presence of manganese-zinc and manganese-cobalt diphosphates to –3.26 and –3.22, respectively. In case of steel electrode in the background solution cathodic current density logarithm at potential –1.0 V reached –2.15. In the presence of diphosphates it decreased to –3.02 and -2.84, respectively. The magnitude of steel corrosion potential of steel (E) in the background solution was –0.32 V (regarding to NHE). Addition to the background solution of Mn(II), Co(II), Zn diphosphates practically did not shift the E value, that demonstrated an equal inhibition of cathode and anode processes at steel corrosion. The revealed anticorrosive action of diphosphates can be stipulated by the formation of protective coatings on a steel surface. They were found out by visual, gravimetric and X-ray researches. Thus, the experimental results show that for the first time synthesized Mn(II), Co(II), Zn diphosphates solid solutions revealed anticorrosive properties and can be used as inhibitors of steel corrosion in the acidic environment.

References

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