SOLUTIONS OF DIFFERENT CORROSIVITY AT CATHODIC POLARISATION

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Stress-corrosion cracking (SCC) pecularaties of X70 steel for main pipelines in solutions with pH from 5.6 to 9.6 at cathodic polarization using slow strain rate tests, volumetry, masometry, optical metallography, and SEM were carried out. Results indicated that maintaining of protective potential for anticorrosion protection of pipelines at the level -1.050 V (that is the maximum protective potential) is not as dangerous as it can be, because can led to SCC by hydrogen embrittlement mechanism. So, decision for choice of maximum protective potential have to accepted depending on corrosivity of environment.

Keywords: stress-corrosion cracking, polarization, hydrogen, protective

Introduction. SCC of main gas pipelines is the most dangerous type of their demolition, cause its hard predictability, rate of propagation and scale of collapses [1]. Therefore, the studies of regularaties of that phenomena are extraordinarily important from the first case of SCC was identificated [2] to now days. In this study the main patterns of SCC of X70 steel were examined in solution of different corrisivity which will make the appreciable contribution to fundamental knowledges of SCC.

Research results. Investigations of SCC of X70 steel specimens were carried out by slow strain test method [3] at polarization potentials -0.750, -0.95, and -1.050 V (relative to saturated chloride reference electrode), which are applied using PI-50-1.1 potentiostat with PROGRAMMER PR-8. Solutions for studies were such as: 1 – NS_4, pH 8.2; 2 – 0.1 M $NaHCO_3$ + 0.1 M Na_2CO_3, pH 9.6; 3 – 2.28 g/l HCOOH + 54.4 g/l HCOONa + 10.8 g/l KCNS, pH 5.6.

Analyzing research data, it was established, that corrosion rate of the steel X70 decreasing from 0.08 to 0.0008 mm/year as pH increasing from 5.6 to 9.6 (Fig.1, v_{cor} curve).

Susceptibility to SCC, estimated using KS coefficient, changes in different ways. When the polarization potential was -0.750 V K_S reducing slowly from 1.3 to 1.0 with pH increasing from 5.6 to 9.6 (Fig.1, E_{pol}= -0.750 V curve). Therefore, at minimum protective potential very insignificant influence of pH solution on SCC was observed. But at maximum protective potential -1.050 V non-monotonic altering of SCC sensitivity was established: as pH decreasing from 5.6 to 8.2, K_S downing nearly twice, from 2.4 to 1.15; at further pH rising to 9.6 – K_S increased to 1.31(Fig.1, E_{pol}= -1.050 V curve).

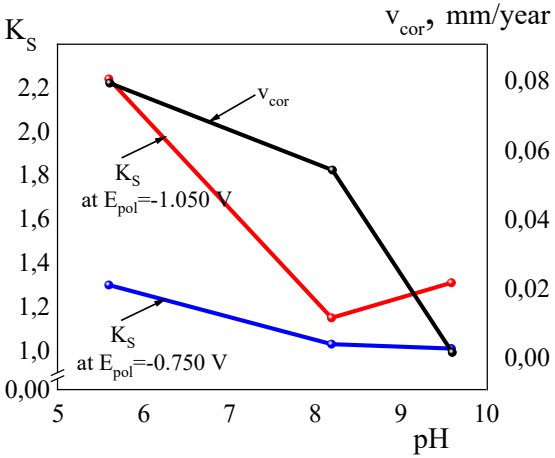

Fig. 1. Change in susceptibility of X70 steel to SCC at potentials -0.75 and -1.050 V and corrosion rate depending on pH of solutions.

Conclusion. It was found that at minimum protective potential SCC susceptibility of X70 steel slightly depreciate as pH reducing, but at maximum protective potential -1.050 V – minimum SCC susceptibility was stated at pH 8.2 with increasing slightly as pH enlarging to 9.6 and rising at pH reducing to 5.6. That scientific results indicated on necessity of differentiated approach to cathodic protection depending on corrosivity of environment.

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