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INFLUENCE OF TEMPERATURE AND CONCENTRATION OF SODIUM HALOIDES ON THE CORROSION RATE OF METALS

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Abstract
This paper presents the results of a study of the influence of the nature of halogen salts on the corrosion rate of St.5 grade metals in a neutral medium pH=7. It was found that in the presence of 0.5 wt.% at 40 about C and exposure time, the corrosion rate of metals is 2.13 . 10 -7 g/m 2 ·h, under the same conditions in the presence of 5.0 wt.% the corrosion rate of metals 2.38 . 10 -7 g/m 2 · h, which means that with an increase in the concentration of sodium chloride, the corrosion rate increases by about 1.11 times.
Keywords: corrosion, sodium chloride, gravimetric method, potassium chloride, sodium bromide, sodium iodide, calcium chloride.

INTRODUCTION

The Republic of Uzbekistan is one of the largest gas producing countries in the world. More than 1,250 gas wells operate on its territory. The gas industry is associated with the consumption of a huge amount of metal, which by its nature is subject to corrosion. Corrosion occurs in preparation for gas production, in the process of its processing and transportation. At gas fields, mainly imported carbon steel is used.

It is known that the temperature and concentration of the solution and the nature of the halogen significantly affect the corrosion of metals. Therefore, the study of the influence of these parameters is of great practical and theoretical importance. The work presented by us presents the results of a study of the influence of the temperature of the solution, the nature and concentration of halides on the corrosion of metals.

The influence of temperature and concentration, as well as the nature of sodium halides on the corrosion rate of St.3 grade metals in a neutral medium pH=7, was studied. The results of which are shown in Table 1.

Analysis of the results of the study (Table 1) shows that among chlorides, bromides and sodium iodides Sodium chloride accelerates the corrosion rate by 1.8 times Art.3 than bromide and iodide. For example, at 20 $^{\circ}$C, the corrosion rate of metals in the presence of bromide and sodium iodide, the corrosion rate is $1.95 \cdot 10^{-7}$ g / m $^2 \cdot$ h and $1.17 \cdot 10^{-7}$ g/m $^2 \cdot$h, respectively.

Table 1 Effect of temperature and concentration of sodium halides on the corrosion rate of metals (exposure time 72 hours, pH=7)

No.	Name of metal halide	Concentration solution, %	exposure time, hour	Temperature, ° C		
				20	40	60
				SC, g/m ^{2} .h		
1.	Sodium chloride	0.5	72	2.12 · 10-7 –	2.33 · 10-7 –	2.59 · 10-7 –
2.	Sodium chloride	5.0	72	2.23 · 10-7 –	2.68 · 10-7 –	2.88 · 10-7 –
3.	sodium bromide	0.5	72	1.95 · 10-7 –	1.98 · 10-7 –	2.02 · 10-7 –
4.	sodium bromide	5.0	72	2.04 · 10-7 –	2.19 · 10-7 –	2.33 · 10-7 –
5.	sodium iodide	0.5	72	1.17 · 10-7 –	1.22.10 $^{-7}$	1.37 · 10-7 –
6.	sodium iodide	5.0	72	1.46 · 10-7 –	1.53 · 10-7 –	1.64 · 10-7 –

With an increase in the concentration of sodium halides from 0.5 wt.% to 5.0 wt.%, the corrosion rate of metals increases. For example, in the presence of 0.5 wt.% at 40 ^{about} With the corrosion rate of metals 2,33 · 10 $^{-7}$ g/m ^{2} ·h, under the same conditions in the presence of 5.0 wt.%, the corrosion rate of metals is 2.68 · 10 $^{-7}$ g/m ^{2} · h, which means that with an increase in the concentration of sodium chloride, the corrosion rate increases by about 1.15 times.

The effect of the solution temperature on the corrosion rate of metals in the temperature range of 20-60 ° C was also studied . It has been found that the rate of corrosion increases with increasing temperature . For example, in the presence of 5.0 wt.% sodium bromide at 20 ^{about} With the corrosion rate of metals 2.04 · 10 $^{-7}$ g / m ^{2} ·h, and at 40 and 60 ° C in the presence of sodium bromide at the same concentration, the corrosion rate is 2.19 · 10 $^{-7}$ g / m ^{2} · h and 2.33 · 10 $^{-7}$ g/m ^{2} ·h, respectively.

The effect of metal halides on corrosion of metals was also investigated, the results of which are presented in Fig. 1.

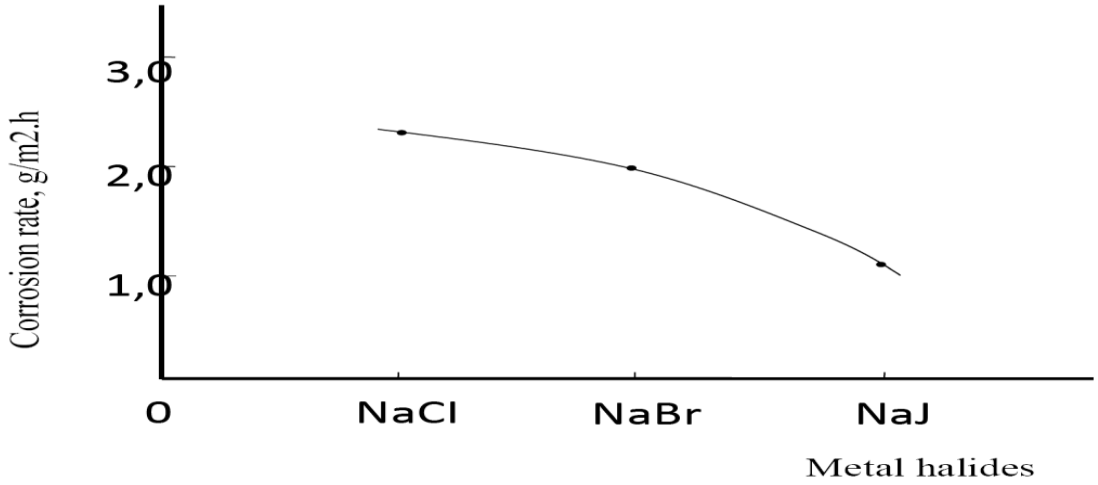

Fig.1 Influence of 0.5% concentrations of metal halides on the corrosion rate (SC) at a temperature of 40 ° C in a neutral environment (exposure time -72 hours).

The work presented by us presents the results of a study of the effect of sodium chloride concentration , solution temperature, exposure time and the nature of metals on the corrosion

rate of metals. The influence of the concentration of sodium chloride solution in the range of 0.1-5.0 wt. %. It was found that with an increase in the concentration of sodium chloride, the corrosion rate of metals increases. For example, in the presence of 0.1 wt. % at 20 $^{\circ}$C (exposure time 48 hours) corrosion rate of metals $0.89 \cdot 10^{-7}$ g/m ^{2} ·h, under the same conditions in the presence of 5.0 wt.% the corrosion rate of metals $2.06 \cdot 10^{-7}$ g / m ^{2} · h, then with an increase in the concentration of sodium chloride, the corrosion rate increases by about 2.32 times.

Table 2 Effect of temperature and concentration of metal chloride solution and duration of exposure to corrosion rate (pH=7)

No.	**Name of metal halide**	Concentration solution, %	**exposure** time, hour	Temperature, ^{o}C		
				20	40	60
				SC, g/m ^{2}.h		
1.	Sodium chloride	0.1	48	$0.89 \cdot 10^{-7}$	$1.08 \cdot 10^{-7}$	$1.39 \cdot 10^{-7}$
2.	Sodium chloride	0.5	48	$1.17 \cdot 10^{-7}$	$1.15 \cdot 10^{-7}$	$1.52 \cdot 10^{-7}$
3.	Sodium chloride	1.0	48	$1.85 \cdot 10^{-7}$	$1.89 \cdot 10^{-7}$	$1.99 \cdot 10^{-7}$
4.	Sodium chloride	5.0	48	$2.06 \cdot 10^{-7}$	$2.13 \cdot 10^{-7}$	$2.28 \cdot 10^{-7}$
5.	Sodium chloride	0.1	72	$1.33 \cdot 10^{-7}$	$1.36 \cdot 10^{-7}$	$1.51 \cdot 10^{-7}$
6.	Sodium chloride	0.5	72	$1.45 \cdot 10^{-7}$	$1.47 \cdot 10^{-7}$	$1.56 \cdot 10^{-7}$
7.	Sodium chloride	1.0	72	$1.88 \cdot 10^{-7}$	$1.91 \cdot 10^{-7}$	$2.11 \cdot 10^{-7}$
8.	Sodium chloride	5.0	72	$2.16 \cdot 10^{-7}$	$2.24 \cdot 10^{-7}$	$2.34 \cdot 10^{-7}$
9 .	Calcium chloride	0.1	144	$0.298 \cdot 10^{-6}$	$0.345 \cdot 10^{-6}$	$0.184 \cdot 10^{-6}$
10 .	Calcium chloride	0.5	144	$1.36 \cdot 10^{-6}$	$1.73 \cdot 10^{-6}$	$2.11 \cdot 10^{-6}$
11 .	Calcium chloride	1.0	144	$2.42 \cdot 10^{-6}$	$2.50 \cdot 10^{-6}$	$2.83 \cdot 10^{-6}$
12 .	Calcium chloride	5.0	144	$3.28 \cdot 10^{-6}$	$2.61 \cdot 10^{-6}$	$3.8 \cdot 10^{-6}$

The rate of corrosion of metals on the temperature of the solution has been studied. It is determined that with increasing temperature, the corrosion rate increases (Table 2). The effect of calcium chloride content on the corrosion rate of metals was also studied . It was found that in the presence of calcium chloride, the corrosion rate of metals is greater than that of sodium chloride.

Thus the rate of corrosion of metals depends on the concentration and temperature of the solution, as well as on the length of time.

The influence of the concentration of calcium chloride on the corrosion rates of metals was also investigated, the results of which are presented in Fig. 2.

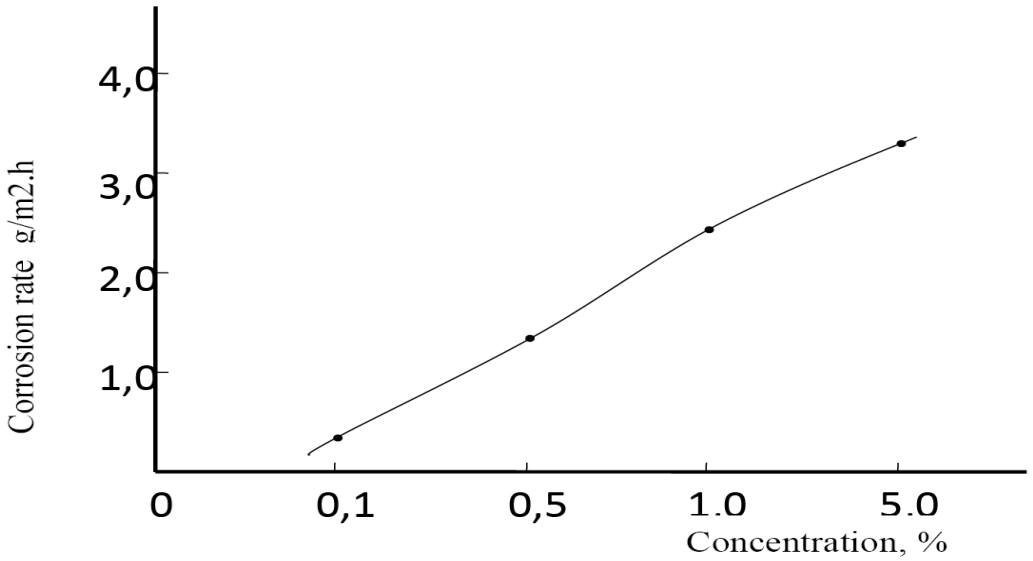

Fig. 2. Influence of calcium chloride concentration on the corrosion rate (SC) in a neutral environment at a temperature of 20 ˚C (exposure time -144 hours).

Our work presents the results of a study of the effect of sodium chloride concentration, solution temperature, exposure time and the nature of metals on the corrosion rate of metals. The influence of the concentration of sodium chloride solution in the range of 0.1-5.0 wt. %. It was found that with an increase in the concentration of sodium chloride, the corrosion rate of metals increases. For example, in the presence of 0.1 wt. % at 20 ˚C (exposure time 48 hours) corrosion rate of metals $0.89 \cdot 10^{-7}$ g/m ^{2} ·h, under the same conditions in the presence of 5.0 wt.% the corrosion rate of metals $2.06 \cdot 10^{-7}$ g/m $^2 \cdot$ h, which means that with an increase in the concentration of sodium chloride, the corrosion rate increases by about 2.32 times.

Table 3 Effect of temperature and concentration of sodium chloride solution and duration of exposure to corrosion rate (pH=7)

No.	Name of metal halide	Concentration solution, %	time , hour	Temperature, ºC		
				20	40	60
				SC, g/m ^{2} .h		
1.	Sodium chloride	0.1	48	0.89 · 10-7 –	1.08 · 10-7 –	1.39 · 10-7 –
2.	Sodium chloride	0.5	48	1.17 · 10-7 –	1.15 · 10-7 –	1.52 .10 $^{-7}$
3.	Sodium chloride	1.0	48	1.85 · 10-7 –	1.89 · 10-7 –	1.99 · 10-7 –
4.	Sodium chloride	5.0	48	2.06 · 10-7 –	2.13 · 10-7 –	2.28 · 10-7 –
5.	Sodium chloride	0.1	72	1.33 · 10 $^{-7}$	1.36 · 10 $^{-7}$	1.51 · 10 $^{-7}$
6.	Sodium chloride	0.5	72	1.45 · 10-7 –	1.47 · 10-7 –	1.56 · 10-7 –
7.	Sodium chloride	1.0	72	1.88 · 10-7 –	1.91 · 10-7 –	2.11 · 10-7 –
8.	Sodium chloride	5.0	72	2.16 · 10-7 –	2.24 · 10-7 –	2.34 · 10-7 –

The rate of corrosion of metals on the temperature of the solution has been studied. It is determined that with increasing temperature, the corrosion rate increases (Table 3).

Thus, the rate of corrosion of metals depends on the concentration and temperature of the solution, as well as on the length of time.

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