
INFLUENCE OF CHLORIDE ON THE ANODE DISSOLUTION OF AISI 304 STEEL

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Abstract

The kinetics of anodic dissolution of stainless steel in acidic sulphate-chloride solutions was studied. The regularities of changes in the electrochemical parameters (stationary potential, passivation potential, passivation current density, transpassivation potential) with varying concentration of NaCl are established.

Keywords: Stainless steel, voltammetry, concentration, passivation.

Introduction

One of the main reasons for the use of stainless steels in industry is its corrosion resistance. However, according to literary data, stainless steels, incl. and the studied AISI 304 steel, is not resistant in concentrated hydrochloric acid, since the Cl⁻ ion has active depassivation properties [1-3]. Chlorine ions are able to adsorb with oxide films and displace oxygen from them, thus forming soluble ferric chloride, which leads to the development of intergranular corrosion.

The main cause of passivity is currently considered to be the formation of a thin continuous oxide film on the metal surface, which separates it from the electrolyte and prevents the direct transfer of metal atoms from the metal phase to the

electrolyte [4,5]. Salt films, usually porous and not solid, can limit the surface in contact with the electrolyte, increase the true current density and thereby facilitate the transition to passivity [6-8].

Research results

Anodic polarization curves were recorded using the linear voltammetry method [9], which have all the kinetic regions: active dissolution, active-passive state, and transpassivation region (figure 1). It has been established that when chlorides are added to the electrolyte, the stationary potential is shifted to the electronegative side. The current density of passivation is higher than in the background solution, which is explained by the active action of depassivators. The

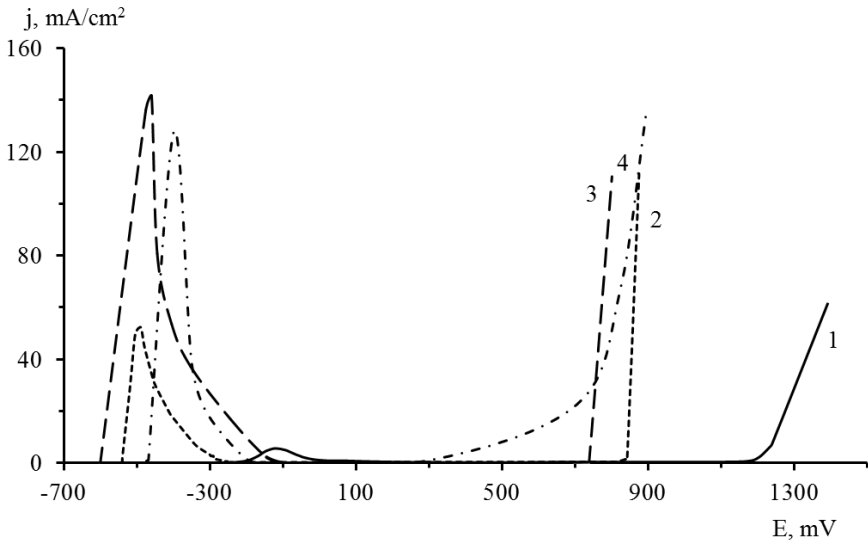


Figure 1. Anode polarization relationships for the ALSI 304 steel in the solutions containing, mol·L⁻¹: 2,4 H₂SO₄ (1); 2,4 H₂SO₄, 0,5 NaCl (2); 2,4 H₂SO₄, 0,85 NaCl (3); 2,4 H₂SO₄, 1 NaCl (4)

region of transpassivation occurs faster with the introduction of chlorides and the is observed at lower potentials.

Thus, the presence of chloride ions in a solution of sulfuric acid has a negative effect on the anodic dissolution of AISI 304 steel. It was determined that in all the considered concentration intervals a passive state is observed, but at the same time the passivation current increases and the stationary potential shifts towards the electronegative side, which is explained by the active action of depassivators.

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