

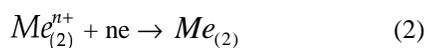
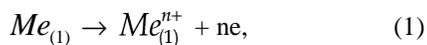
## PASSIVATION OF ALUMINIUM AND ITS ALLOYS BY STRONG OXIDIZERS

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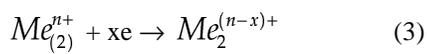
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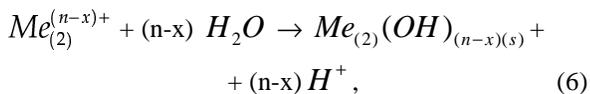
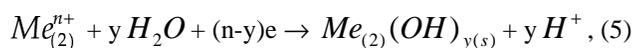
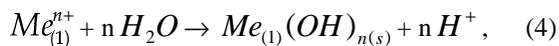
Proposed is a method for improvement of corrosion resistance including a pitting corrosion of aluminium and its alloys, based on metal displacement reactions. By this approach, following anodic and cathodic reactions can proceed in aqueous solution containing  $Me_{(2)}^{n+}$  ions at the  $Me_{(1)}$ /electrolyte solution interface under  $E_{corMe(1)}$ , corrosion potential:



From (1) and (2) follows that while  $Me_{(1)}^{n+}$  will dissolve,  $Me_{(2)}$  deposits at the  $Me_{(1)}$  surface. In this case,  $Me_{(2)}^{n+}$  ion acts as "depolarizer". If aqueous electrolyte solution contains  $Me_{(2)}$  ions at its highest oxidation state (for example,  $Me_{(2)}O_3^-$ ,  $Me_{(2)}O_4^{2-}$  or  $Me_{(2)}O_4^-$ ) incomplete reduction of these ions can also take place at  $E_{corMe(1)}$ :



$Me_{(1)}^{n+}$ ,  $Me_{(2)}^{n+}$ , and  $Me_{(2)}^{(n-x)+}$  ions can form hydroxides at the  $Me_{(1)}$  surface according to:



$Me_{(1)}(OH)_{n(s)}$ ,  $Me_{(2)}(OH)_{y(s)}$  and

$Me_{(2)}(OH)_{(n-x)(s)}$  can form complex oxy-hydroxides

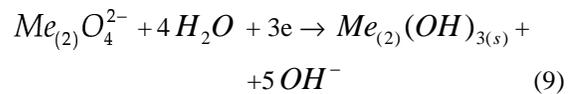
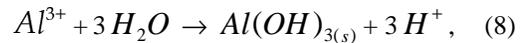
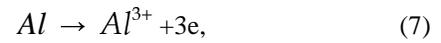
layer of type:  $Me_{(1)}Me_{(2)} \cdot (2n-x+y) H_2O$ .  $Me_{(2)}$  can

be as ion of various oxidation states. When  $Me_{(2)}^{n+}$  ion with high affinity for oxygen is used as "depolarizer," formed complex oxy-hydroxide layers display better protective properties than oxide-hydroxides of  $Me_{(1)}$  and  $Me_{(2)}$ .

Usually used in practice chromate films are formed according to such mechanism during metals and alloys passivation on our opinion. Chromate film is also polymerized because process of their obtaining proceeds at more high temperatures than 298 K. It

contains  $Cr^{3+}$  and  $Cr^{6+}$  ions and show high protective properties under various conditions.

If aluminium or its alloys are used as  $Me_{(1)}$  and  $Me_{(2)}O_4^{2-}$  ion as "depolarizer" next reactions can proceed at the interface:



$Al(OH)_{3(s)}$  and  $Me_{(2)}(OH)_{3(s)}$  form complex oxide-hydroxides of type  $AlMe_{(2)} \cdot n H_2O$  which contain  $Me_{(2)}^{3+}$ ,  $Me_{(2)}^{6+}$  and  $Al^{3+}$  ions. Formed complex oxide-hydroxide layers show essentially more high protective properties than those of oxide-hydroxide  $Al_2O_3 \cdot n H_2O$ .

In the present work, ecologically more friendly  $Me_{(2)}O_4^{2-}$  type ions were used to passivate aluminium and its alloys in aqueous electrolyte solutions. Specimens of 2024 and 7075 alloys were treated by solution containing  $Me_{(2)}O_4^{2-}$  type ion as "depolarizer" at temperature 353 K for 30 - 120 s, washed by distilled water and wasted. Then specimens were polarized in solution of 3% NaCl from corrosion potential at scan rate  $1 \cdot 10^{-2}$  V/s. (Potentiostat PI-50-1-1, Russia). The other specimens after treatment by such solution were weighed and then immersed into seawater to carry out corrosion investigation. In this case investigated specimens were stood the test up to appearance of pitting at the alloys surface. Then they were taken out from corrosive media, washed, wasted and weighed again.

It is found that corrosion and pitting potentials of aluminium, its alloys 2024, 7075 et al. in seawater increased up to 0.100 V after their treatment in such solutions. Corrosion and pitting rates decreased respectively. It is shown that the corrosion properties of the deposits obtained by the proposed method are similar compared to the chromate films, which are usually applied for protection of metals and alloys in liquid corrosive media. A composition of protective films forming during treatment of alloys by proposed method is also similar compared to the chromate films.