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CHEMICAL AND ELECTROCHEMICAL STUDIES ON CHROMATE PASSIVATION OF BRASS (*)

D.P.Sinha, Kanhaya Singh,
S.K. Sanyal and S.N. Pandey,
Defence Research Laboratory
(Materials), Kanpur.

Brass is found to corrode by a process known as dezincification. There are three types of dezincification (i) Selective corrosion of zinc in brass (ii) redeposition of copper on brass surface and (iii) a combination of processes (i) & (ii). The corrosion is manifested on brass either as 'layer type' when the attack is laterally distributed or as 'plug type' when the attack is concentrated to points resulting in pitting and finally perforation.

Dezincification by deposition theory was supported by electron optics studies.

Restricted supply of oxygen, high temperature and contact with chloride ions increase the incidence of dezincification. Proper alloying specially with small quantities of tin, aluminium, antimony, arsenic, phosphorous etc. increases corrosion resistance of brass. Provision of electrical insulation against contact with nobler metals and alloys should be a part of designing complexes with brass.

This paper describes results of the passivation of brass obtained by chemical and electrochemical methods. The effect of time of etching and of the presence of Cl' ion has been studied.

It is thought that a prior etching of brass and specific concentration of Cl'/SO_4'' is essential to achieve a good passivation. In chemical passivation this is done by incorporating Cl' ions. In the electrochemical process this is achieved by impressing anodic current on brass.

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In the chemical process the increase in the time of pickling results in more metal loss with practically no gain in the character of the passivated film. The passivation film obtained after 30 seconds pickling followed by 10 seconds passivation is equally tenacious and corrosion resistant compared to that obtained by 2 mts. pickling followed by 10 seconds passivation. Similarly, though the film weight of the passivation film increases with increasing time of passivation, no substantial gain is achieved in the character of the film. Hence 30 seconds pickling followed by 10 seconds passivation treatment is considered ideal. Moreover the film obtained under these conditions was found to be adherent.

In the electrochemical process with NaCl alone it was observed that the potential remained unchanged while the impressed current was raised from 40 to 100 $\mu a/cm^2$. Brass was found to have suffered from dezincification during this period. To ascertain the exact current density when brass suffers from maximum dezincification, a curve was traced impressing current at different current densities between 40 and 100 $\mu a/cm^2$. All the curves show initial rise in potential which gradually fall to become steady after 15 minutes. However, at current density of 55 $\mu a/cm^2$ the metal loss is highest and maximum dezincification was visible. Hence it is concluded that for dezincification 55 $\mu a/cm^2$ is the limiting current density beyond which the process of dezincification seems to be retarded.

Passivation of brass was carried out in acidified sodium chromate bath at current densities of 31, 48 and 55 $\mu a/cm^2$. The maximum adherence was observed in case of passivation of 55 $\mu a/cm^2$. The passivated films obtained with current densities of 31 and 48 $\mu a/cm^2$ had poor adhesion and at current densities higher than 55 $\mu a/cm^2$ practically no assivated film was visible. The electrode potentials of passivated panels in 5% NaCl solution plotted against time, shows that the potentials start at -200 mv Vs SCE and fall with time. Steady potential is, however, reached by the brass passivated at 55 $\mu a/cm^2$ current density, which also shows the most +ve potential.

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Brass, like Cu, is only slightly attacked by sodium chloride. Anodic polarisation supplements this attack and induces active dissolution of the alloy. Near a specific current density (55 $\mu a/cm^2$) there is maximum dissolution of brass redeposition of copper resulting in severe dezincification and when some copper and zinc ions are freely formed on the surface of brass due to the influence of anodic current, these ions react with the chromate and with lapse of time form small crystals on the surface of brass which becomes perfect on drying and confer passivation.

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