ELECTROCHMEISTRY OF LEAD IN ACID ALCOHOLS

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The electrochemistry of lead in inorganic acid solutions has extensively been studied due to its technological importance of lead-acid batteries [1]. In organic acids, however, the electro-dissolution and possible passivation of lead depend on the nature and strength of the acidic media. A recent study in tartaric acid [2], claims that the corrosion of lead increases with pH and the slope of E_{corr} *vs.* pH is 30 $mVpH^{-1}$. The purpose of the present work is to study corrosion of lead in different acid alcohols; tartaric (TTH_2), malic (MMH_2), succinic (SSH_2) and lactic (LH) acids and their corresponding sodium salts. Methods of cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) under the condition of stationary and rotating disc electrodes have been used. The present study confirms that the dissolution / passivation of lead in acid alcohols depends on the structure of the acid and its acidity strength. In the direction of LH(L-) to TTH2(TT2-) , CV-studies showed unhindered dissolution to partial passivation. In the anodic half cycle, two types of films form with that forming at lower potentials is more susceptible to attack by the anions, Fig. 1. A single broad to multiple cathodic peaks are indicative of the reduction of the surface film and ions in the nearby solution. The passivation seems to be under ohmic control and a mechanism based on the involvement of bi-dentate and bridged anions has been suggested and accounts for the entire results, scheme 1. EIS-studies exhibited two overlapping semi-circles of various diameters terminating to a large semicircle or a segment of a straight line via a small conductive loop indicating impedance characteristics of the partially passivating film, interfacial resistance, anion adsorption and transport in the solution layer near the surface.

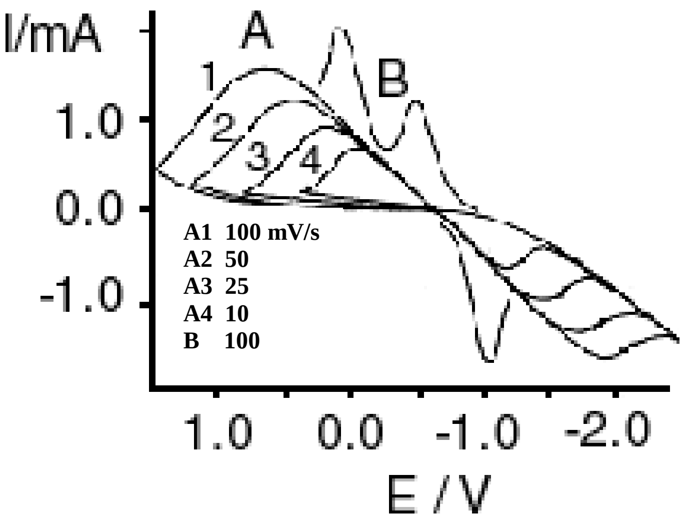
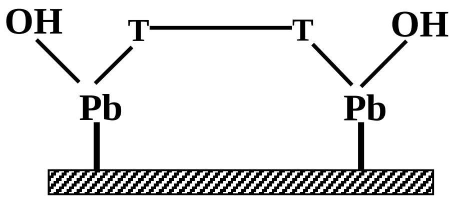


Fig.1: Cylic voltammograms at various potential sweep rates.
(A) 0.1 M tartaric acid/Pb
(B) 0.1 M sodium-di-tartarate/Pb



Scheme 1

References

[1] BKUHN A.T., Electrochmeistry of Lead, Academic Press, London (1981).

[2] Gobal F, Malek K, J. Electrochem. Soc. India, 47(1998)23.