Chemical Dissolution of Metals in Strong Acidic Media

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First chemical dissolution of metals was revealed in the experiments in which the amalgams of metals decomposed in the alkaline solutions/1/. Then Ya.M.Kolotyrkin and co-workers determined a fact of chemical dissolution of Fe, Cr and steels in the strong acidic media/2,3/. The characteristic features of this phenomenon are an independence of the metal dissolution rate on the electrode potential at the cathodic polarization, stirring the solutions and an anion nature. Afterwards similar anomalous dissolution in the aqueous solutions of the strong acids was revealed by other investigators for various metals, in particular, Mn/4/, Ti/5/, Zr/6/, Zn, Al, Co, etc. Our researches in the strong acidic alcohol media have confirmed and given concrete expression to the chemical dissolution on an example of iron, steels, Zn, Cr, Ti/7-10/. The peculiarities of such process besides above-mentioned are: - exceeding the corrosion rate measured on the basis of the electrode weight losses over the electrochemical corrosion rate (iel) derived from the polarization-measurement data several orders of magnitude (Fe, Zn, Ti); - the independence of the metal dissolution rate on potential at the cathodic (aqueous and alcohol media) and the wide anodic-potential region (alcohol media); - the negative and fractional values of dlgich/dpH frequently (ich the chemical dissolution rate) while this value for the iel is positive; - sharp decrease of iel and increase of ich 1-3 orders of magnitude (Fe, Zn, Ti, Cr) in the alcohol media as compared with aqueous ones; - the presence of gas hydrocarbons, together with hydrogen, in the gas phase evolving during the dissolution of metal; - the invariability of the composition of gas phase on the alcohol nature and the electrode potential at the wide potential region. The received data had allowed to propose the radical mechanism of chemical dissolution of metals based on the destruction of the chemisorbed solvent molecules the possibility of which was confirmed by the thermodynamics calculations/11/. Our recent investigation of hydrogen diffusion into the steel in the alcohol HCl solutions has shown its dependence on the ich of the metal. Decreasing ich with increasing the water concentration in the alcohol solvent and with decreasing the HCl concentration results in increase of hydrogen diffusion into the metal. References. 1. Korshunov V.N., Iofa Z.A.// Dokl. AN SSSR(Rus).1961. V.141.N1. P.143-146. N2. P.413-416. 2. Florianovich G.M., Kolotyrkin Ya.M.//Dokl. AN SSSR(Rus).1964.V.157.N2.P.422-425. 3. Knyazheva V.M., Sumarokova I.S., Kolotyrkin Ya.M.//Protection of Metals (Rus).1968. V.2.N6. P.628-635. 4. Kolotyrkin Ya.M., Agladze T.R.//Protection of Metals (Rus).1968. V.4.N6.P.721-724. 5.Mansfeld F., Kenkel J.V.//Corrosion Sci. 1976.V.16.N9.P.653-657. 6. Straumanis M., James W., Custead W. //J.Electrochem.Soc.1960.V.107.P.502. 7. Tsygankova L.E., Vigdorovitch V.I.//Protection of Metals (Rus).1977.V.13.N4.P.436-438. 8. Vigdorovitch V.I., Tsygankova L.E. //J.Appl. Chem. (Rus).1978.V.51.N8.P.1877-1878. 9.Vigdorovitch V.I., Tsygankova L.E.//J. Phys.Chem.(Rus) 1981. V.55.N10.P.2464-2468. 10. Tsygankova L.E.,Vigdorovitch V.I.,Turovskaya R.V. and other.// Protection of Metals (Rus).1989.V.25.N1.P.97-100. 11. Vigdorovich M.V., Tsygankova L.E., Vigdorovitch V.I.//Chem. and Chem. Technol.(Rus). 1999.V.42.N3.P.3-12.