Anodic Reaction Mechanisms of Zinc in Acidic and Alkaline Solutions by Electrochemical Quartz Crystal Microbalance

Y. Takeda[1], M. Itagaki[1,z], K. Watanabe[1], H. Katayama[2], and K. Noda[2]

1. Department of Pure and Applied Chemistry, Faculty of Science and Technology, Tokyo University of Science, Noda, Chiba 278-8510, Japan.
2. Corrosion Research Group, National Institute for Materials Science, Sengen, Tsukuba, Ibaraki 305-0047, Japan

z; itagaki@rs.noda.tus.ac.jp

Zinc works as a sacrificial anode in contact with iron, because it is less noble metal than iron. Therefore the galvanized iron pipe is widely used. Additionally zinc covered with its oxide film has a fine corrosion resistance depending on the properties of water.

The corrosion mechanisms of zinc are complex, thus it is quite important to investigate the anodic behavior of zinc in various environments. Feitknecht[1)] studied the corrosion product of zinc and proposed pCl-pH diagram of zinc. Hayashi *et al.*[2)] indicated the mistake in the diagram by Feitknecht and proposed the revised pCl-pH diagram[1)] of zinc. Hayashi *et al.*[3)] revealed the anodic reaction mechanisms of zinc in chloride solutions by the reaction parameters determined from anodic polarization curves. Additionally, Hubber[4)] reported that the passive films ZnO and $Zn(OH)_2$ formed on the zinc electrode surface at nobler potential than the potential of active dissolution in alkaline solutions. However, there are a lot of unclear problems regarding the anodic dissolution and the passivation of zinc.

Firstly in the present paper, anodic reactions of zinc are characterized by measuring the anodic polarization curves in the solutions of various pH's, and the reaction parameters about anodic reaction are obtained. Secondly, the mass changes of the zinc electrode are measured simultaneously with the measurement of the anodic polarization curve by electrochemical quartz crystal microbalance (EQCM). On the basis of the above-mentioned results, the anodic reactions of zinc in various solutions are proposed.

References

1) W. Feitknecht: *Chemistry and Industry*, **36**, 1102 (1959).
2) K. Hayashi, S. Tujikawa : *Zairyo-to-Kankyo*, **50**, 292 (2001).
3) K. Hayashi, Y. Miyoshi: *Tetsu-to-Hagane*, **78**, 601 (1992).
4) K. Hubber: *J. Electrochem. Soc.*, **100**, 376 (1953).