A multi-ion transport model of Cu-Zn-Fe trimetallic couple in near-neutral NaCl solution

Lei Chen[1,2], Rongyao Ma[2], Junhua Dong[2], Changgang Wang[2]

[1] *School of Materials Science and Engineering, University of Science and Technology of China, Shenyang 110016, China*

[2] *Shenyang National Laboratory for Materials Science, Institute of Metal Research, Chinese Academy of Sciences, Shenyang 110016, China*

Presenter's e-mail address: lchen18s@imr.ac.cn

Abstract Galvanic corrosion is a form of failure in electrically connected structural materials where the components with lower corrosion potential often serve as sacrificial anodes and components with higher corrosion potential are often protected as cathodes. Corrosion potential difference plays an important role in galvanic corrosion. Also, geometric parameters such as area ratio show effect on galvanic corrosion. Extentisive investigation has been carried out on bimetallic galvanic corrosion rather than multimetallic galvanic corrosion which exists widely due to multiple demands of metallic alloys in different parts of equipment. A numerical model was proposed to investigate the corrosion behavior of Cu-Zn-Fe trimetallic couple in near-neutral 3.5 wt.% NaCl. Evolution of current density, pH and soluble corrosion products were simulated in one-dimensional scale. The model predicted acidification on Zn surface and alkalization on Cu and Fe surfaces. pH evolution is related to corrosion products distribution. Zn^{2+} is the dominant specie formed on the middle of Zn surface. Zn hydrolytes are preferentially formed above the resin. Above the cathode surfaces distant from Zn, the concentration of corrosion products remains as zero.

Keywords Trimetallic galvanic corrosion; FEM; ion composition evolution

Reference

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