Influence of static magnetic field on microbiologically induced corrosion of Cu-Zn alloy in SRB culture medium

Bi Chen, Hongwei Liu, Shuang Qin, Hongfang Liu*

Hubei Key Laboratory of Materials Chemistry and Service Failure, School of Chemistry and Chemical Engineering, Huazhong University of Science and Technology, Wuhan 430074, China

The corrosion behavior of Cu-Zn alloy in SRB culture media by Sulphate-Reducing Bacteria (SRB) biofilm under a 200mT static magnetic field (SMF) was investigated using Electrochemical Impedance Spectroscopy (EIS), Scanning Electron Microscopy (SEM) and X-ray Photoelectron Spectrum (XPS). The free-corrosion potential (E\text{corr}) was generally much more negative in the presence of SMF. After 14 days immersion, the number of SRB in biofilm with SMF were 4.5 × 10^3 cells/cm² and without SMF were 1.0 × 10^8 cells/cm², which showed that SMF decreased the sessile SRB and triggered SRB biofilm dispersion. SEM, EDAX and XPS demonstrated that in presence of SMF, the protect film were compact and the corrosion products were mainly Cu$_2$O, Cu$_2$S and very little Cu(II)X, which were very different from the corrosion products without SMF mainly Cu(II)X. The EIS of samples which were cultured in inoculated SRB media in the presence and absence of SMF in sterile media were tested. EIS showed that SMF resulted in the separation of the SRB biofilms from the Cu-Zn coupon surfaces. At the same time, the applied SMF accumulating the compact protective products film that deposited on the surface of the Cu-Zn alloy. Thus, SMF mitigated both biofouling and Microbiologically Influenced Corrosion (MIC) can be controlled.

Keywords: SRB biofilm, copper alloy, static magnetic field, MIC

* Corresponding author, Tel:+86-27-87543432,
E-mail address: liuhf@hust.edu.cn (Hongfang Liu)