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INTERNATIONAL CONFERENCE
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MEETING POINT OF THE SCIENCE AND PRACTICE IN THE FIELDS OF
CORROSION, MATERIALS AND ENVIRONMENTAL PROTECTION

*STECIŠTE NAUKE I PRAKSE U OBLASTIMA KOROZIJE,
ZAŠTITE MATERIJALA I ŽIVOTNE SREDINE*

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Green Corrosion Inhibitors with Cysteine and Cerium-Cysteine Complex on 7000 series Aluminum Alloy

Zeleni inhibitori korozije sa cisteinom i kompleksom cerijum-cisteina na 7000 seriji aluminijumske legure

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Abstract

The aim of this study was to investigate environmentally-friendly corrosion inhibitors based on the cerium-cysteine and their effect on 7xxx series aluminum alloy. The cysteine and cerium-cysteine complex structures were analyzed by Fourier-Transform Infrared spectroscopy (FTIR). The structure of cerium-cysteine was additionally determined using Nuclear Magnetic Resonance (NMR) and Elemental Analysis. Inhibitors efficiency was analyzed with Electrochemical Impedance Spectroscopy (EIS) and Potentiodynamic polarization techniques in 0.1M NaCl at room temperature, while Scanning Electron Microscopy analyzed the surface appearance and microstructure of the tested aluminum alloy with Energy Dispersive Spectroscopy (SEM / EDS) and Optical Microscope (OM). Different amounts of cysteine were examined in order to find an optimal concentration of inhibitor. The adsorption of the inhibitors followed the Langmuir isotherm, and based on the EIS results and calculated thermodynamic potential (Gibbs free energy), cysteine and cerium-cysteine proved to be good inhibitors for tested aluminum alloy. The optimal cysteine concentration of 0.06 mM as a corrosion inhibitor of 7xxx series aluminum alloy was determined. EIS diagrams confirmed that cysteine showed better inhibition than Ce-Cys complex.

Keywords: aluminum alloy; green corrosion inhibitor; cysteine; cerium; EIS;

Izvod

Cilj ovog rada je ispitivanje ekološki prihvatljivi inhibitori korozije na bazi cerijuma-cisteina na leguri aluminijuma serije 7xxx. Strukture cisteina i kompleksa cerijum-cisteina analizirane su Fourierovom transformacijom infracrvenog zračenja, a struktura cerijum-cisteina je određena i korišćenjem nuklearne magnetne rezonancije i elementalne analize. Efikasnost inhibitora je analizirana elektrohemijском impedansnom spektroskopijom (EIS) i tehnikama potenciodinamičke polarizacije u rastvoru 0,1M NaCl na sobnoj temperaturi, dok su izgled površine i mikrostruktura ispitivane legure aluminijuma analizirani skenirajućom elektronskom mikroskopijom sa energo-disperzivnom spektrometrijom i optičkim mikroskopom. Adsorpcija inhibitora prati Langmirovu izotermu, a na osnovu EIS rezultata i izračunatog termodinamičkog potencijala (Gibsova slobodna energija) cistein i cerijum-cistein su se pokazali kao dobri korozije. Utvrđena je optimalna koncentracija od 0,06 mM cisteina kao inhibitor korozije aluminijumske legure serije 7xxx. EIS merenjima je potvrđena veća stabilnost cisteina od Ce-Cys kompleksa.

Ključne reči: legura aluminijuma; zeleni inhibitori korozije; cistein; cerijum; EIS;.