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Effect of equal channel angular pressing (ECAP) on erosion-corrosion of pure copper
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Abstract
During the past few decades, ultrafine-grained materials (UFG) have experienced rapid development. Enhanced mechanical and surface properties, such as strength, ductility and erosioncorrosion (E-C) resistance by refining the grain to ultra-fine/nanometer size has been achieved. The equal channel angular pressing (ECAP) is a popular severe plastic deformation (SPD) method to fabricate UFG bulk materials. In this research, the E-C behavior of commercial annealed pure copper subject to four passes of ECAP have been investigated. Hardness measurement of the copper specimen after four passes of ECAP showed an increase of 200% on the hardness value as compared with annealed condition. Simulated seawater was used as an E-C medium. The effect of different EC parameters such as time, slurry flow velocity, impact angle, and solid particle concentration on ECAP process is studied. The results showed that ECAP enhances the E-C resistance of copper, and this behavior improves with increasing the pass number. Generally, a 30% rise in resistance to E-C was achieved after four ECAP passes as compared to coarse grain copper for the parameters studied in this work. Optical microscopy was used to examine the microstructure and material removal mechanism of the annealed copper. Scanning electron microscopy (SEM) was used to validate the reduction of grain size due to ECAP process. Furthermore, examination of the surface roughness of the copper at different ECAP passes showed that for the same E-C condition the increment of ECAP passes leads to a smoother surface. © 2017 by the authors.

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