ABSTRACT

Retrogression and reaging (RRA) behaviour of the 8090 and 1441 Al-Li-Cu-Mg-Zr alloys has been characterized by hardness and tensile testing, TEM, XRD, DSC studies, electrical resistivity measurements and electrochemical polarisation techniques. RRA treatments applied to the 8090 (Al-2.29Li-1.24Cu-0.82Mg-0.12Zr) and 1441 (Al-1.9Li-2.0Cu-0.9Mg-0.09Zr) alloys have resulted in retaining the peak aged strength with the microstructures approaching those of the over aged tempers. Stress corrosion cracking (SCC) tests have been carried out on the 8090 and 1441 alloys in the peak aged, retrogressed and reaged, and over aged tempers by means of slow strain rate technique (SSRT) and constant load method in 3.5% NaCl, 3.5% NaCl + 0.1M LiCl + 0.3% H_2O_2 and 3.5% NaCl + 0.1M LiCl + 0.7% H_2O_2 solutions. SSRT tests have also been performed on these alloys of different tempers under applied anodic and cathodic potentials in 3.5% NaCl solution. SCC studies in different media has strengthened the fact that to promote SCC failure, a condition of passivation is essential. RRA treatments and an increase of aging time have been found to improve the SCC resistance and this has been discussed in correlation with the microstructural changes associated with the RRA treatments and aging time. Detailed studies of fracture surfaces and the mode of SC cracking of both these alloys reveal that crack initiation has taken place either from the base of the pits or from other heterogeneities such as intergranular fissures, but the SC crack propagation paths are predominantly intergranular and subintergranular. The experimental and fractographic evidences support a local anodic dissolution (LAD) mechanism for SSC in these alloys. However, at higher applied cathodic potentials hydrogen embrittilement seems to be operative and RRA tempers are more susceptible.

Key words: 8090 and 1441 Al-Li alloys, Retrogression and reaging, Stress corrosion cracking, Slow strain rate test.