The 2nd International Conference on welding, nondestructive testing and the industry of materials and alloys (ICWNDT-MI'10)

2010

INFLUENCE OF THERMO-MECHANICAL TREATMENTS ON MECHANICAL PROPERTIES OF 2024 ALUMINUM ALLOY

A. Naimi, H. Yousfi

Abstract : In this work, the 2024 aluminum alloy homogenized and cold rolled at several rates was heat treated at 190 0 C and the effect of precipitation hardening on hardness was investigated as a function of time and rate of cold rolling by using Vickers microhardness measurements. It was concluded that the variation in time and rateof cold rolling can improve the hardness of the alloy. The work revealed that cold rolling and time play an important role in the precipitation hardening process ofthe alloy. The hardness of the alloy increase with the rate of the cold rolling, however the maximum hardness, an optimum aging cycle should be used. The variation in hardness of samples in differentrates of cold rolling when they artificially aged for different intervals of time is shows that as the aging time and temperature increases, a continuous increase in hardness is observed except in the case of the non cold rolled sample where the hardness stabilizes for some hours before continuing the increasing which is attributed to the formation of Guinier–Preston–Bagaryatsky zones(GPB zones) [1]. Further increase in the aging time results in a maximum after which the hardness decreases. These maximums of hardness are attributed of formation of S ' (Al2CuMg) metastable phase[2]. However the decreasing of the hardness is caused by the formation of the equilibrium precipitate (S) which has the same chemicalcomposition as the metastable phase but a different lattice parameter[3]. This increasing and decreasing of hardness after a maximum value is a dominant trend for all of the samples at all of the aging conditions (time and rate of cold rolling). However, there are some differences between them. First, the time to reach maximum hardness decreases as the rate of cold rolling increases caused by defects introduced by cold rolling which increase the diffusion coefficient of atoms. Also, maximum hardness increases as a result ofincreasing of the rate cold rolling. Results show that in precipitation hardening process, a complex sequence of time-rate cold rolling-dependent factors are involved

Keywords : Alloy, Precipitation, hardness