ABSTRACT

There is a general interest in increasing the fatigue life of materials. Shot peening is the process commonly used in order to increase the fatigue strength and life of Aluminum alloys.

The effect of shot peening on fatigue-creep performance of AA5086-O, AA6061-T651 and AA7075-T651 Aluminum alloys was investigated for specimens tested under control stress rotating bending at a stress ratio R=-1 and 250 °C temperature.

Tests under variable loading were compared, and the experimental damage was calculated before and after shot peening of specimens at temperature 250 °C. Fatigue – creep interaction lives predicted by the linear damage rule were compared to the actual lives. The results showed that the linear damage rule predictions overestimated the life of fatigue-creep interaction with shot peening.

The cumulative fatigue-creep interaction damage was found to be around 0.5 for AA5086-O and AA6061-T651 Aluminum alloys. AA7075-T651 Aluminum alloy was found to be the most affected alloy at elevated temperature and had the highest creep damage magnitudes.

A cumulative damage and fatigue life model was used. It is based on the S-N curve and taking into account the effects of load history and shot peening time. The obtained fatigue lives from this model showed a conservative estimation compared to the experimental lives, while the Miner's rule estimation was observed to be conservative for some specimens when experimental damage $D_{exp.} \geq 1$ and non-conservative for other specimen lives ($D_{exp.} < 1$).

Finite element analysis using (ANSYS 11) program was used to validate the experimental results and simulate rotating bending. ANSYS was used to illustrate the available life for stress life fatigue analysis for the three selected Aluminum alloys.

A comparison between three methods was carried out for three Aluminum alloys based on the experimental results. These methods were:

1- Model.
2- Miner rule.
3- (ANSYS 11).

The main conclusions derived from this work were that the predictions due to model and ANSYS agreed with the experimental ones while Miner predictions were not accurate compared to the experimental results.