Congresso Brasileiro de Engenharia e Ciência dos Materiais
06 a 10 de Novembro de 2022 | Águas de Lindóia – SP – Brasil

FATIGUE BEHAVIOR OF THE Al-5wt%Si-2.5wt%Cu ALLOY PRODUCED BY COMBINING GRAIN REFINING TECHNIQUES: ELECTROMAGNETIC STIRRING WITH Al-5wt%Ti-1wt%B CHEMICAL GRAIN REFINER

Wendel L. Beil[1], Gabriela L. Brollo[2], Cristiano Cardoso[3] e Eugênio J. Zoqui[4]

1 – Instituto federal de educação ciência e tecnologia de São Paulo, IFSP campus Itaquaquecetuba
3 - Instituto SENAI de Inovação em manufatura avançada e micro fabricação.
2 e 4 – Faculdade de Engenharia Mecânica, Universidade Estadual de Campinas (UNICAMP).
Rua Mendeleyev, 200, CEP 13083860, Campinas, SP.
w109311@dac.unicamp.br

ABSTRACT

The fatigue behavior of the Al-5wt%Si-2.5wt%Cu alloy is studied in this article. The effect of combining techniques for grain refining, via chemical grain refining (Al-5wt%Ti-1wt%B alloy) added to electromagnetic stirring is shown in this work. This combination produced a microstructure with reduced grain size (121 ± 20 µm) when compared with the raw material produced only by electromagnetic stirring (213 ± 38µm), with Al-5wt%Ti-1wt%B grain refiner only (184 ± 23 µm) or without any grain refining technique (413 ± 96 µm). Grain size was measured by the intercept's method of Heyn, using color micrographs obtained by polarized light. The condition produced by associating electromagnetic stirring with the Al-5wt%Ti-1wt%B grain refiner presented the smallest grain size and less porosity. Then, this condition was chosen to continue the evaluation of the mechanical performance of the studied alloy via tensile tests, whose results for ultimate stress, yield stress and elongation were, respectively, σ_u = 208 ± 10 MPa, σ_y (0.2%) = 135 ± 3.5 MPa and ε(%) = 2.9 ± 0.1. Fatigue tests were conducted via the staircase method using the results of the tensile tests. The average estimate of fatigue strength for a given life (10^7 cycles) and the standard deviation calculated were, respectively, $\hat{\mu}_y$= 71.6 MPa and $\hat{\sigma}_y$= 6.42. The specimens used in the tests were manufactured by turning, whose roughness was kept and is inherent to conventional machining processes in general, such as those performed on mechanical components such as gear box joint faces and bearing housings.
This work was carried out with the support of Fapesp (Process 2018/11802-4).

Keywords: *fatigue, staircase method, grain refining, electromagnetic stirring.*