Experimental Study to Obtain (S-N) Curve for Aluminium Alloy (ALMg1SiPb) In Normal & Lower Temperatures [*]

Eng. Iyad Alusta Halabi [**]

Dr. Khalil Azimah [***] **Dr. Majed Haiba** [****]

Abstract

This paper describes the experimental work carried out in order to obtain the stress-number of cycles to failure curve (S-N curve) for aluminium alloy AlMg1SiPb at temperatures of (20°C) and (-50°C). The details of the specimens considered, testing procedures and processing of results were taken according to the requirements of the ASTM standards. In order to guarantee the accuracy of the specimen's dimensions and smoothness, special cutting, grinding, polishing and measuring machines and instruments were used in the preparation of the specimens. In addition, to insure correct application of loading cycles, computerized testing rig was used and an alignment test was considered according to the requirements of ASTM standards.

The obtained results showed that the possibility of carrying out tests to get (S-N) curves using locally available resources is visible. Additionally, S-N curves for aluminium alloy AlMg1SiPb which are, to the best of the authors knowledge, not available in the public domain are now available for temperatures of (20°C) and (- 50°C).

Keywords: Fatigue strength, Fatigue tests, Surface roughness, (S-N) curves.

For the Paper in Arabic see pages (303-334)

[*] This paper prepared through scientific research to obtain PHD degree for engineer Iyad Alusta Halabi.

[**] Scientific Studies and Research Center (SSRC) - Damascus- P.O.Box 4470.

[***] Teacher – Mechanical design department- Faculty of mechanical and electrical engineering- Damascus University.

[****] Main researcher- Scientific Studies and Research Center (SSRC) - Damascus- P.O.Box 4470.

References:

1. L. F. Coffin, Fatigue in Machines and Structures – Power Generation, Fatigue and Microstructure, pages 1–27. ASM, 1979.
2. Fernend Ellyin, Fatigue Damage, Crack Growth and Life Prediction, Chapman& Hall, ISBN 0 412 59600 8, 1997.
3. Chr. Boller & T. Seeger, Materials Data for Cyclic Loading, Elsevier Science Publishing INC, New York, ISBN 0-444-41685-4, 1987.
4. MIL-HDBK-5H, Military Handbook: Metallic Materials and Elements for Aerospace Vehicle Structure (01 Dec 1998).
5. M. R. Mitchell, Fundamentals of Modern Fatigue Analysis for Design. In Fatigue and Fracture, Volume 19 of ASM Handbook, ASM International, 2002
6. J. Morrow, Fatigue Properties of Metals. In J. A. Graham, editor, Fatigue Design Handbook, SAE, 1968.
7. B. Leis, Effect of Surface Conditions and Processing on Fatigue Performance. In Fatigue and Fracture, Volume 19 of ASM Handbook, ASM International, 1996.
8. G. R. Leverant, B. S. Langer, A. Yuen, and S. W. Hopkins. Surface Residual Stresses, Surface-Topography and the Fatigue Behaviour of Ti-6Al-4v. Metallurgical Transactions A-Physical Metallurgy and Materials Science, 10(2): 251–257, 1979.
9. L. Wagner, Mechanical Surface Treatments on Titanium, Aluminium and Magnesium Alloys. Materials Science and Engineering A, 1999 263(2):210–216.
10. W. Schutz, A history of fatigue, Engineering Fracture Mechanics, 1996 54(2): 263–300.
11. AG, Doldertal, Key to Metals, INI International & Step-commerce 32, Switzerland.
12. EN 754-2-1997.
13. R.J. Bucci, G. Nordmark, E.A. Starke, ASM Handbook, volume 19, ASM International, 1996.
14. Prakash Chandra Gope. Determination of Minimum Number of Specimens in S-N testing. Journal of Engineering Materials and Technology, 124(4):421– 427, 2002.
15. Majed Haiba, Experimental Stress Analysis, MSC Course, Strathclyde University, 1992.
16. Ri-ichi, Morakami, Fatigue Properties of Aluminum Alloy (A6061-T6) with Ultrasonic Nano-Crystal Surface Modification. University of Tokushima, Japan.