Study of Internal Temperature and Surface Roughness at Constant Speed and Constant Load While Wear Testing Process of Al25Mg2Si-2Cu-4Mn Alloy

Shruti S Walikar[1], Neeta S Mathapati[2]
[1]PG Student, production Engineering and system technology, Department of Mechanical Engineering B L D E A's Dr. P. G. H CET vijayapur-586103, Karnataka, India
[2]Associate professor, Department of Mechanical Engineering, B L D E A's Dr. P. G. H CET vijayapur-586103, Karnataka, India

***Abstract*—[In this paper the investigation is done on the internal temperature and roughness of worn surface of T6 heat treated Al25Mg2Si-2Cu-4Mn alloy. Initially the Al25Mg2Si-2Cu-4Mn alloy has undergone for T6 heat treatment, were the preheating and homogenization process is carried out. The specimen are divided into four groups, each group are again subdivided into 2groups which are tested for constant speed and constant load at certain time duration. The wear test is conducted for each specimen and temperature is measured and the resulted that temperature fluctuates with respect to time. And the further surface roughness is calculated on worn surface and resulted that the value of roughness in low at constant speed than that of constant load.**

***Index Terms*—[Internal temperature, Preheating, homogenization, Surface roughness.**

I. INTRODUCTION

Surface roughness often shortened to roughness, is a component of surface texture. It is quantified by the deviations in the direction of the normal vector of a real surface from its ideal form. If these deviations are large, the surface is rough; if they are small, the surface is smooth. Roughness is typically considered to be the high-frequency, short-wavelength component of a measured surface. However, in practice it is often necessary to know both the amplitude and frequency to ensure that a surface is fit for a purpose.

Roughness plays an important role in determining how a real object will interact with its environment. Rough surfaces usually wear more quickly and have higher friction coefficients than smooth surfaces. Roughness is often a good predictor of the performance of a mechanical component, since irregularities in the surface may form nucleation sites for cracks or corrosion. On the other hand, roughness may promote adhesion.

Although a high roughness value is often undesirable, it can be difficult and expensive to control in manufacturing. Decreasing the roughness of a surface will usually increase its manufacturing costs. This often results in a trade-off between the manufacturing cost of a component and its performance in application.

Roughness can be measured by manual comparison against a "surface roughness comparator", a sample of known surface roughness, but more generally a Surface profile measurement is made with a profilometer that can be contact (typically a diamond stylus) or optical (e.g. a white light interferometer).

However, controlled roughness can often be desirable. For example, a gloss surface can be too shiny to the eye and too slippery to the finger (a touchpad is a good example) so a controlled roughness is required. This is a case where both amplitude and frequency are very important.

II. EXPERIMENTAL DETAILS

A.Heat treatment

The samples as cast Al-25Mg2Si-2Cu-4Mn alloy ingots are subjected to heat treatment. Initially the

preheating process is carried out by soaking time of 25minutes for 420̊ c and rapid cooling in ice cold water bath, and then followed by homogenization process. Before starting the process first the ingots are turned into pins of 33mm height and 10mm diameter. In this process the 32 pins are required so that four groups can be made where each group contains 8 specimens which are further subdivided for wear test. Now the soaking time starts by maintaining the furnace temperature at 210°C and then 1, 2, 3 and 4th row of specimens are removed for 1, 3, 5 and 7hours respectively, further they are cooled in the room temperature. Now these specimens are ready for the further wear test.

B. Wear test

In this work all the sample pins were tested on the pin-on-disc wear testing machine which is supplied by DUCOM instruments, Bangalore, India. The set up of the computerized pin-on-disc machine is shown in the below figure.

Fig 1: Pin-on-disc wear testing machine

Before the wear is carried out the hole is drilled at opposite side of surface were wear is to be carried, the holes of 25mm depth and 2mm diameter are drilled for the purpose of measurement of internal temperature of the pins while machining process. For the temperature measurement the thermocouple is used as set up shown schematically in the fig 2.

Fig 2: Pin-on-disc machine with thermocouple setup

The wear test is conducted using a hardened counter-face of a polished disk of EN-32 with a hardness of HRC 62-65 at the comparative humidity of 50-70% at room temperature of 35°C.

C. Surface roughness

In this present work surface roughness test is carried out on the worn surface of the specimens and this test was carried out. The random samples are picked from each group and are subjected to the test. The apparatus, shown schematically in the figure 310, for the surface roughness test was provided and certain instruction were provided before test starts, next the specimen is placed in the anvil and the probe of the surface roughness testing apparatus is set at correct position and the testing is started.

Fig 3: surface roughness testing apparatus

The probe moves on the worn surface and gives the reading in the dial indicator and reading are observed and recorded. Sample 2 to 3 readings are taken and average surface roughness is calibrated. The roughness value is measured in µm.

III. RESULTS AND DISCUSSION

Temperature value in the constant load condition is uniformly increased as shown in figure 4.1(b). But in the figure 4.1(a) there is slight fluctuation in the values due to different intervals of time.

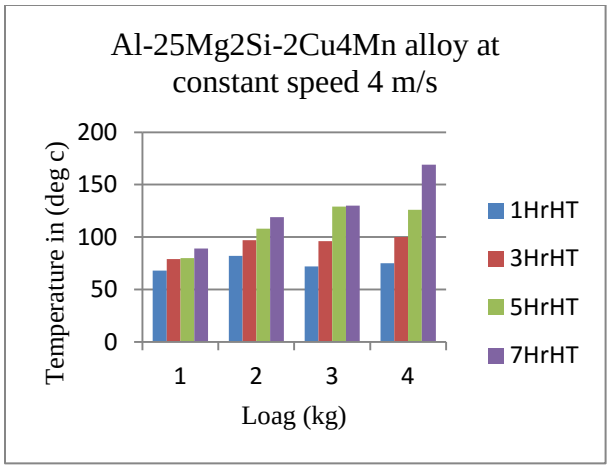

Fig 4.1(a): Temperature at constant speed

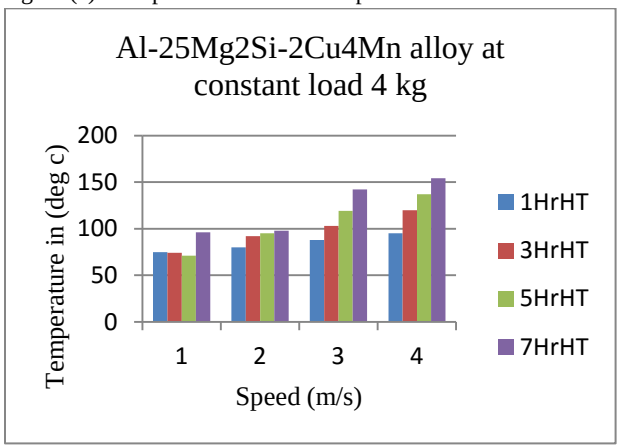

Fig 4.1(b): Temperature at constant load

The surface roughness test is conducted by selecting each specimen from each group. The first column (SR, CS) indicates surface roughness at constant speed and second column (SR, CL) indicates surface roughness at constant load. The surface roughness at constant speed is less as compared to constant load as shown in below graph (fig 5).

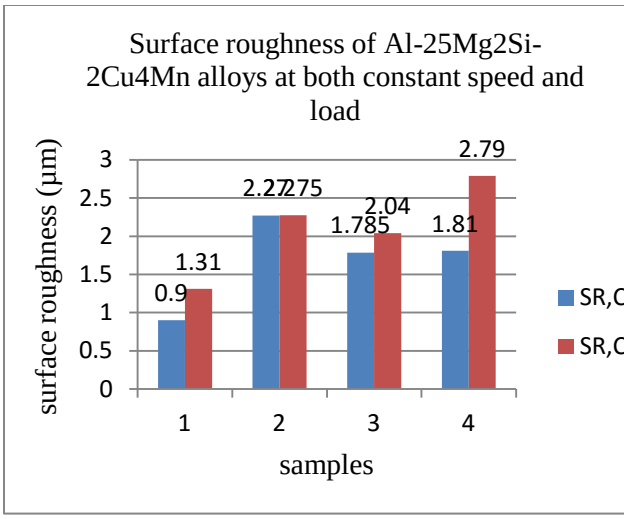

Fig 5: Surface roughness graph

IV. CONCLUSION

It is observed that if there is fluctuation in time period, there will be fluctuation in the temperature. The value of surface roughness is high at constant load and less at constant speed.

ACKNOWLEDGMENTS

The authors express their thanks to Dr. V. P. Huggi, Principal of B.L.D.E.A's V.P.Dr.PG.H.College of Engg. & Tech Vijayapur, Prof.S.B.Koulagi, Head of Department, Department of Mechanical Engineering and to Prof. P. B. Kowalli, Associate Professor, Department of Mechanical Engineering, B.L.D.E.A's V.P.Dr.PG.H.college of Engg. & Tech Vijayapur., for their support and encouragement during the research studies.

.

REFERENCES

1. microstructure and Mechanical property study of 6xxx alloys. Journal. 46(2):98-107, 2010.
2. Niyas Salim, Arun M and Anup kumar, "Effect of Mg enhancement in the microstructure and mechanical properties of AC2A aluminium alloy". Int. journal of research in engineering and technology, ISSN(E): 2321-8843; ISSN(P): 2347-4599, vol.2, 2014, 139-148
3. Roshan Zameer Ahamed and Lohit B.H, "Influence of reinforcement particles on Dry sliding Wear behavior of Aluminium 7034 metal matrix composites", E ISSN 2348-1269, P ISSN 2349-5138, vol. 2, 2015.
4. Satpal Kundu, Dr.B.K.Roy, Ashok Kr Mishra, "Study of Dry sliding wear behavior of Aluminium/SiC/Al2O3/Graphite hybrid metal matrix composite using Taguchi technique". Int. Journal, vol. 3, 2013 ISSN 2250-3153.
5. I.J.Polmear, "Aluminium Alloys- A century of Age Hardening". Material forum vol. 28, 2014.
6. T.G.Rajiv, Sangeeth.P.T, M.H.Annaiah, C.G.Ranjani, Hareendra kumar H.V, "The Effect of heat treatment on mechanical properties and dry sliding wear behavior of A2014 reinforcement with Alumina". Int. Journal of innovative research in sci., engineering and tech. vol.2, 2013, ISSN 2319-8753.