



## Mechanical Properties of Burnished Steel AISI 1008

Zeyad D. Kadhim\*

Mohammed Abdulraoof Abdulrazzaq\*\*

Wassan Suheil Hussain\*\*\*

\*, \*\*\*Department of Materials Engineering/ College of Engineering/ AL-Mustansiriyah University /Baghdad/ Iraq

\*\*Department of Mechanical Engineering/ College of Engineering /AL-Mustansiriyah University /Baghdad, Iraq

\*Email: [dr.zeyad@yahoo.com](mailto:dr.zeyad@yahoo.com)

\*\*Email: [mohammedraof415@yahoo.com](mailto:mohammedraof415@yahoo.com)

\*\*\*Email: [wassansona93@gmail.com](mailto:wassansona93@gmail.com)

(Received 24 December 2017; accepted 3 June 2018)

<https://doi.org/10.22153/kej.2018.06.005>

### Abstract

Burnishing improves fatigue strength, surface hardness and decrease surface roughness of metal because this process transforms tensile residual stresses into compressive residual stresses. Roller burnishing tool is used in the present work on low carbon steel (AISI 1008) specimens. In this work, different experiments were used to study the influence of feed parameter and speed parameter in burnishing process on fatigue strength, surface roughness and surface hardness of low carbon steel (AISI 1008) specimens. The first parameter used is feed values which were (0.6, 0.8, and 1) mm at constant speed (370) rpm, while the second parameter used is speed at values (540, 800 and 1200) rpm and at constant feed (1) mm. The results of the fatigue test showed that improvement in fatigue limit, where the highest fatigue limit was obtained at (1mm feed, 1200rpm speed) in burnishing process which was (169 Mpa). The hardness results, showed increasing feed and speed values lead to increasing the hardness. The burnishing process reduces surface roughness by producing accurate and better surface finish. The best surface fineness of metal at (1mm feed and 1200 rpm speed) was 0.11  $\mu\text{m}$ .

**Keywords:** burnishing process, Fatigue properties, low carbon steel (AISI 1008), surface hardness of low carbon steel, surface roughness of low carbon steel.

### 1. Introduction

Fatigue strength is one of most common mechanical properties. Durability and reliability of car part is usually defined by its fatigue resistance, so most of them can be loaded by dynamic load. Failure of fatigue often begins from surface of the metal. That is related with the fact that most severe fatigue plastic deformations occur in one grain thickness layer of the metal surface [1]. Most of the surface treatments produces compressive stresses at the metal surface, which reduce the probability of crack initiation and then its expansion at the interface between (the surface and core), thus increasing the metal resistance to fatigue [2]. Most important

impacts of roller burnishing improve the fatigue strength, the surface hardness and surface roughness. This process can be transform tensile residual stresses, present in the surface zone after turning, to compressive residual stress [3]. Burnishing process is a cold working process in which plastic deformation happens by applying the pressure within a roller or ball on metal surface. This process is also strengthening and finishing process [4]. Burnishing process is low cost metal surface treatment and applied to improve quality of the surfaces [5]. D. Mahajan and R. Tajane (2013) [6] showed that a burnished surface has a high surface hardness and better fatigue life. Results explained that aluminum and steel materials are chosen by the authors. Results showed that roller burnishing process parameters

such as burnishing force, speed and feed improve fatigue strength and produce better surface finish. M. Rao et al (2011) [7] showed that different experiments are conducted for explaining influence of burnishing forces and number of the tool passes on metal surface hardness and metal surface roughness of mild steel samples. Results showed that improvement in the surface roughness and surface hardness were achieved by application of roller burnishing process with mild steels specimen. Sh. Dwivedi et al. (2014) [8] studied the mechanical properties (hardness, tensile strength and ductility) of A356/5%SiC metal matrix composites for unburnished samples and burnished samples. The results showed that the roller burnished samples of A356/ 5% SiC led to improve surface hardness and ductility. S. Thamizhmanii and S. Hassan (2009) [9] studied that burnishing process carried out for improving surface hardness, surface roughness, fatigue strength and compressive residual stresses, this is accomplished by using sliding feed rates, speeds and penetration depths. This process smooth out peak and valley on the metal surface and accomplished by multiroller burnishing fitted in housing and freely rotates in a horizontal axis. Korzynski M. et al (2011) [10] studied effect of burnishing parameters on the surface roughness and obtained from the mathematical model, and multi nominals of second order that allows for the interactions of input factors for the burnished 42CrMo4 alloy steels shafts. From analysis of results it was concluded that the surfaces micro hardness increased by up for 29%. Franzen V. et al (2010) [11] showed that parameters of the roller burnishing process had high effect on surface topology of friction elements and their tribological properties. S. Thamizhmanii (2008) [12] studied investigation of surface hardness and surface roughness on titanium alloys by using roller burnishing tool that were accomplished by many authors and the results were presented. F. Gharbi et al (2011) [13] investigated that the surface hardness for AISI 1010 steel increases with increasing number of passes for burnishing tool and burnishing force. F. Shiou et al (2003) [14] used Taguchi L18 Orthogonal array techniques and ANOVA to study surface roughness value. It was found that Vickers hardness improved from

338 to 480 after ball burnishing and the surface roughness improving of injection parts on plane surface was 62.9% and that on the free form surface was 77.8%. U. Shirsat et al (2004) [15] worked on the parametric analysis of ball burnishing and combined turning. Results explained that the micro hardness increased with force up for certain extent. M. El-Axir (2000) [16] studied mathematical models that presented to predict surface roughness and micro hardness of St-37 caused by roller burnishing process under lubricated condition. It was shown that a spindle speed, burnishing feed, burnishing force and number of passes have significant influence on surface micro hardness and surface roughness.

## 2. Aim of the Research

The main objective of this research is to find the fatigue limit of untreated and burnished low carbon steel AISI 1008 by using surface forming process named burnishing process, also examine the mechanical properties of low carbon steel AISI 1008 such as hardness and surface roughness.

## 3. Experimental Work

### 3.1 Materials

The material studied in this current work was low carbon steel alloy type of AISI 1008 which is used in various steel components, such as gears, shafts and cams (according to J. Dossett and G.E. Totten [17]).

### 3.2 Chemical Analysis

Chemical analysis of the tested material (AISI 1008 low carbon steel) was accomplished by (Thermo ARL 3460, optical Emission spectrometer) in State Company for Inspection and Engineering Rehabilitation in Baghdad. The results are compared with American Standard carbon steels test method.

**Table 1,**  
**Chemical Composition for low carbon steel AISI 1008 in wt %.**

Material AISI 1008	Chemical Composition											
	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Fe	
Standard value	0.10 (Max)		0.3- 0.5	0.040 (Max)	0.05							
Actual value	0.073	0.150	0.487	0.005	0.016	0.056	0.002	0.085	0.016	0.222	Bal.	

### 3.3 Stress Relieve of the Specimens

This treatment was carried out by placing the samples in crucible and then put it in the oven at temperature 220 °C for three hours to relieve stresses. This treatment carried out in materials engineering department/ college of engineering/ Al-Mustansiriayah University.

### 3.4 Burnishing Process

The samples used in this work treated with special burnishing tool that worked with a lathe to accomplish this process. There are two variables used in this process, feed and speed. This process carried out on sixty samples of fatigue specimens, first group of this samples consist of thirty samples in which speed parameter is constant and feed parameter is variable (feed values used were 0.6, 0.8, 1mm at 370 rpm constant speed), second group also consist of thirty samples in which feed parameter is constant and speed parameter is variable (speed values used were 540, 800, 1200 rpm at 1mm constant feed). Burnishing process carried out in the mechanical workshop/ college of engineering/Al-Mustansiriayah University as shown in figures (1, 2).



**Fig. 1. Roller burnishing tool.**



**Fig. 2. Burnishing process.**

### 3.5 Fatigue Test

Fatigue test was accomplished by using fatigue test machine of type (HSM20 rotating bending fatigue machine, Germany). The fatigue test specimens prepared according to the (DIN50113) standard specification as shown in Figure (3). To get suitable dimensions of the fatigue specimens according to the standard dimensions of (HSM20 rotating bending fatigue machine), for this, all specimens were manufactured by using conventional lathe machine (Harrison 600, M350, EW700, Germany). To produce good surface finish and to minimize the residual stresses, all specimens manufactured with a careful control. The specimen is subjected to an applied load from the right side which was perpendicular to the axis of specimens, developing bending moment. Therefore; surface of the specimen is under tension and compression stresses when it rotates.

(1)  $\sigma$  (N/mm<sup>2</sup>)= (32 × 125 P)/(π × d<sup>3</sup>) (according to Hashemi, S. [18])

Where  $\sigma$  = stress (N/mm<sup>2</sup>), P = Force in N,

The force arm is equal to 125mm and,

d = minimum diameter of the specimen in (mm).

Constant fatigue tests were conducted in laboratory air (approximately 25-30% relative humidity) at temperature of room using HSM20 rotary fatigue bending machine, Germany, as shown in Figure (4), with a stress ratio of R= -1. The cycle frequency was 50 Hz and the rotating speed used is (3000 cycle/min.). This test was

carried out in Mechanical Engineering Department/ Al- Mustansiriayah University/ Baghdad/ Iraq.

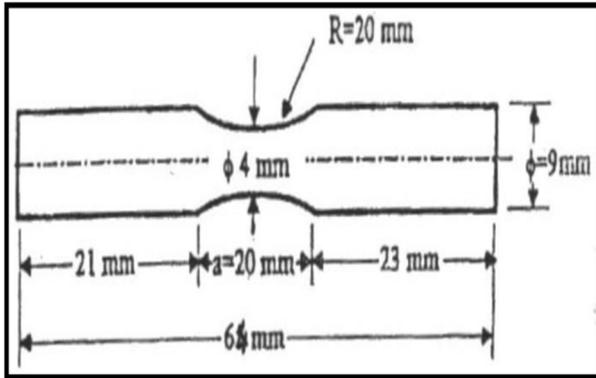


Fig. 3. Fatigue test specimen (dimensions in mm).



Fig. 4 Fatigue testing machine HSM20, (Germany) rotating .

### 3.6 The Surface Roughness Measurement

Surface roughness was measured for the samples which used whose used for fatigue test, and it has found that value of the surface roughness is ranging from (0.156 - 2.181) Micron. Ten samples subjected to surface roughness measurement, where they were measured by using the surface roughness measuring device (TR200).

### 3.7 Microhardness Test

Vickers microhardness test was done on ten samples with a load of 3 N with a load holding time of 10 seconds. Indentations were made starting 0.25 mm from the edge end at an interval of 0.25mm to a distance of 3mm towards the

middle and repeated when specimens turned at right angles from the first measurement.

## 4. Results and Discussion

### 4.1 Fatigue Test Results

Figures [5 - 7] showed the fatigue curves for each condition, it can be seen that the highest value for fatigue limit was (169.102 MPa) for samples that treated with (1mm feed, 1200rpm speed) burnishing process, this is due to the creation high residual compressive stresses at the surface of specimens and also reduce the crack initiation and increase dislocations density during this process (according to Zabkar, B. and Kopač, J. [16]). Table (2) shows an improvement in fatigue limit for sample treated with burnishing process.

Table 2,  
Fatigue of low carbon steel (AISI 1008) results.

Cases	Treatment	Fatigue limit (MPa)	No. of cycle
A	Without treatment	79.6	$2 \times 10^6$
B	Burnishing (speed 370 rpm, feed 0.6mm)	91.5	$5 \times 10^6$
C	Burnishing (speed 370 rpm, feed 0.8mm)	101.5	$6 \times 10^6$
D	Burnishing (speed 370 rpm, feed 1mm)	119.5	$7 \times 10^6$
E	Burnishing (speed 540 rpm, feed 1mm)	139.2	$8 \times 10^6$
F	Burnishing (speed 800 rpm, feed 1mm)	159	$1 \times 10^7$
G	Burnishing (speed 1200 rpm, feed 1mm)	169	$1 \times 10^7$

#### 4.1.1 Fatigue Test Results of as Received low carbon steel (AISI 1008)

Ten Samples were tested at room temperature. The applied stresses were in a range of (79.6-169 MPa). The fatigue limit of untreated low carbon steel (AISI 1008) was at 79.6 MPa.

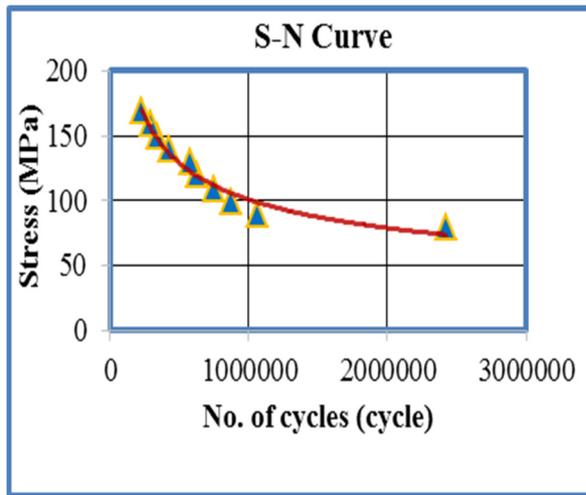


Fig. 5. (S-N curve for untreated low carbon steel AISI 1008)

This group (untreated low carbon steel AISI 1008) subjected to fatigue test in different stresses to extract value of fatigue limit which was 79.6 MPa as shown in figure (5).

#### 4.1.2 Fatigue Test Results of (0.6mm Feed and 370 rpm Speed)

Ten Samples were tested at room temperature. The applied stresses were in a range of (91.5-189 MPa). the fatigue limit of (0.6mm feed and 370rpm) burnished low carbon steel (AISI 1008) was at 91.5 MPa. This value is higher than untreated one, this result due to produce good surface finish, work hardening and compressive residual stresses by plastically deforming the metal surface layer in burnishing process.

#### 4.1.3 Fatigue Test Results of (0.8mm Feed and 370rpm Speed)

Ten Samples were tested at room temperature. The applied stresses were in a range of (101.5-209 MPa). The fatigue limit of (0.8 mm feed and 370 rpm speed) burnished low carbon steel (AISI 1008) was at 101.5 MPa. This group treated with (0.8 mm feed and 370 rpm speed value) burnishing process and subjected to fatigue test at room temperature and the result was that fatigue limit of this group is 101.5 MPa as shown in figure (6), this increasing in fatigue limit due to produce compressive residual stresses and work hardening by plastically deforming the specimens surface layer in burnishing process.

#### 4.1.4 Fatigue Test Results of (1mm Feed and 370 rpm Speed)

Ten Samples were tested at room temperature. The applied stresses were in a range of (119.5-219 MPa). The fatigue limit of (1mm feed and 370rpm) burnished low carbon steel (AISI 1008) was at 119.5 MPa. This group treated with (1 mm feed and 370 rpm speed value) burnishing process and subjected to fatigue test at room temperature and the result was that fatigue limit of this group is 119.5 MPa as shown in figure (6), this increasing in fatigue limit due to produce work hardening and compressive residual stresses by plastically deforming the metal surface layer in burnishing process.

Figure (6) below shows a comparison among S-N curves of untreated samples and (0.6, 0.8 and 1) mm feed values of burnishing process. In this figure it can be seen that fatigue limit improved whenever feed values increased, where untreated samples have fatigue limit (79.6 MPa) while (1mm feed value and 370 rpm speed value) burnished metal have fatigue limit (119.5 MPa).

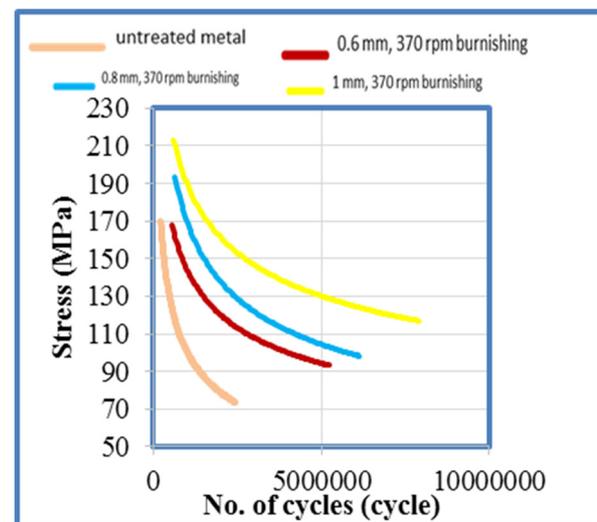


Fig. 6. (S-N for low carbon steel AISI 1008 with burnishing process at different feed and constant speed 370 rpm)

#### 4.1.5 Fatigue test Results of (1mm Feed and 540rpm Speed)

Ten Samples were tested at room temperature. The applied stresses were in a range of (139.2-238.7 MPa). The fatigue limit of (1mm and 540rpm) burnished low carbon steel (AISI 1008) was at 139.2 MPa. This group treated with (1 mm feed and 540 rpm speed value) burnishing

process and subjected to fatigue test at room temperature and the result was that fatigue limit of this group is 139.2 MPa as shown in figure (7), this value higher than untreated one, this is due to work hardening which produce compressive residual stresses at the specimen surface in burnishing process.

#### 4.1.6 Fatigue Test Results of (1mm Feed and 800rpm Speed)

Ten Samples were tested at room temperature. The applied stresses were in a range of (159-248.5 MPa). the fatigue limit of (1mm and 800rpm) burnished low carbon steel (AISI 1008) was at 159 MPa. This group treated with (1 mm feed and 800 rpm speed value) burnishing process and subjected to fatigue test at room temperature and the result was that fatigue limit of this group is 159 MPa as shown in figure (7), this is due to cold working process which produces compressive residual stresses at the specimen surface in burnishing process.

#### 4.1.7 Fatigue Test Results of (1mm Feed and 1200rpm Speed)

Ten Samples were tested at room temperature. The applied stresses were in a range of (169-258.5 MPa). The fatigue limit of (1mm and 1200rpm) burnished low carbon steel (AISI 1008) was at 169 MPa. This group treated with (1 mm feed and 1200 rpm speed value) burnishing process and subjected to fatigue test and the result was that fatigue limit of this group is 169 MPa as shown in figure (7), this is the highest fatigue limit due to cold working process which produce compressive residual stresses by plastic deformation of the specimens surface in the burnishing process.

Figure (7) below shows a comparison among S-N curves of untreated samples and (540, 800 and 1200) rpm speed values of burnishing process. In this figure it can be seen that fatigue limit improved whenever speed values increased, where untreated samples have fatigue limit (79.6 Mpa) while (1mm feed value and 1200 rpm speed value) burnished metal have fatigue limit (169 Mpa).

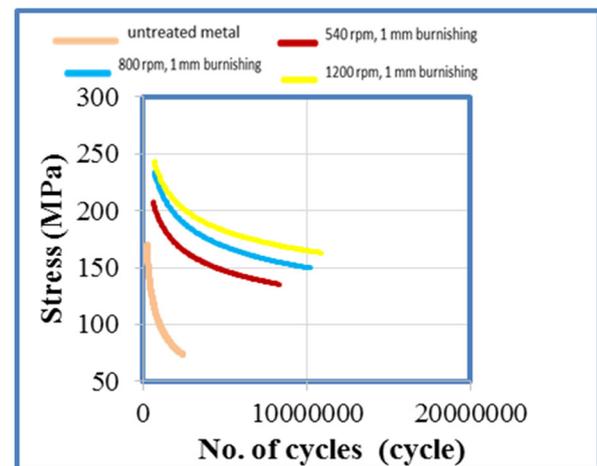


Fig. 7. (S-N for low carbon steel AISI 1008 with burnishing process at different speed and constant feed 1 mm)

## 4.2 Microhardness Test

The surface hardness of the samples has been measured by using Vickers hardness test. In general the surface hardness increased with burnishing process. Values of the surface hardness for the samples were treated with burnishing have higher values than those of untreated, as shown in the Table (3).

Table 3, Vickers microhardness of low carbon steel AISI 1008.

Cases	Treatment	Hardness values for Vickers(HVN)
A	Without treatment	170
B	Burnishing (speed 370rpm, feed 0.6mm)	206
C	Burnishing (speed 370rpm, feed 0.8mm)	207
D	Burnishing (speed 370rpm, feed 1mm)	212
E	Burnishing (speed 540rpm, feed 1mm)	199
F	Burnishing (speed 800rpm, feed 1mm)	210
G	Burnishing (speed 1200rpm, feed 1mm)	220

## 4.3 Discussion of the Microhardness Results

In Figures [(8) and (9)] it can be seen the change in the hardness values. Figure (8) showed how hardness values increased with increase of feed values for used specimens and figure (9) also showed how hardness increased with increase of

speed values for used specimens in burnishing process. From table (3) it can be seen that the surface hardness improved by using burnishing process, from this we can conclude that high value of plastic deformation occurred on the metal surface (according to Zabkar, B. and Kopač, J. [16]).

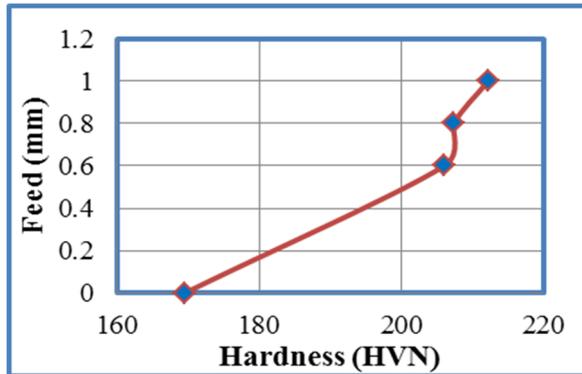


Fig. 8. Effect of feed of burnishing process on hardness at constant speed (370 rpm).

Figure (8) showed how the hardness values increased with increase of feed values in burnishing process for used specimens; this is due to work-hardened surface by plastic deformation, which created from burnishing process. The highest value of the surface hardness obtained when the feed value was (1) mm, at constant speed value which was (370) rpm, which was (212.2) HVN.

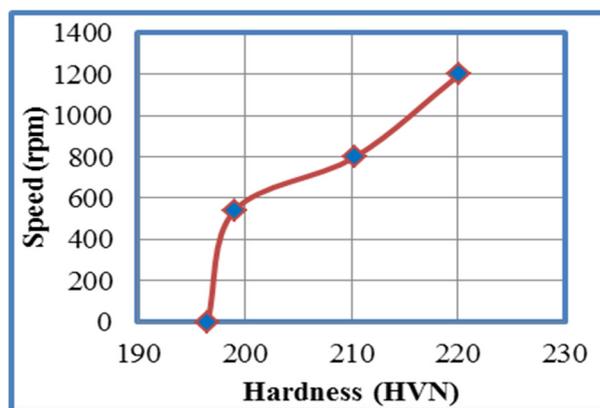


Fig. 9. Effect of speed of burnishing process on hardness at constant feed (1mm).

Figure (9) showed how the hardness values increased with increase of speed values in burnishing process for used specimens. This is because of work hardening during this process, which leads to improve surface quality. The

highest value of the surface hardness obtained when the speed value was (1200) rpm, at constant feed value which was (1) mm, which was (220.13) HVN.

#### 4.4 Surface Roughness Test

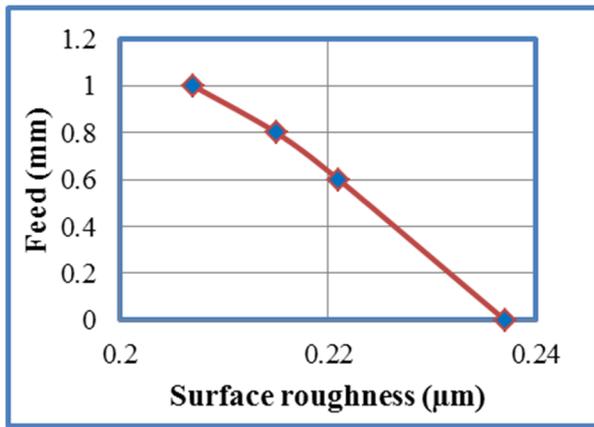
The surface roughness of samples have been measured, and it has been found that surface roughness values decreased for samples that treated with burnishing process. Surface roughness of the samples which treated with burnishing process has lower values than those which untreated, as shown in the table (4).

#### 4.5 Discussion the Results of the Surface Roughness

Table 4, Surface roughness values for samples of low carbon steel AISI 1008

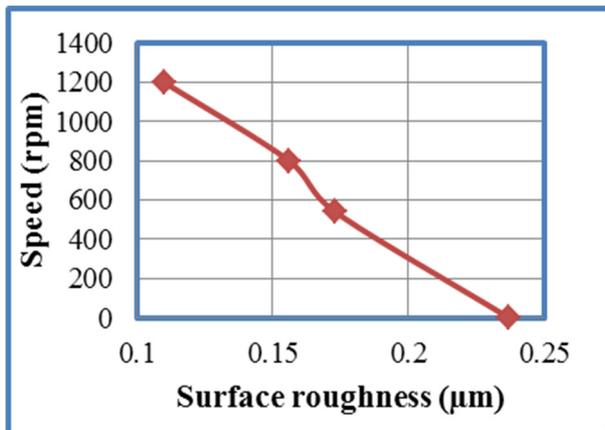
Cases	Treatment	Surface roughness ( $\mu\text{m}$ )
A	With out treatment	0.237
E	Burnishing (speed 370rpm, feed 0.6mm)	0.221
F	Burnishing (speed 370rpm, feed 0.8mm)	0.215
G	Burnishing (speed 370rpm, feed 1mm)	0.207
H	Burnishing (speed 540rpm, feed 1mm)	0.173
I	Burnishing (speed 800rpm, feed 1mm)	0.156
J	Burnishing (speed 1200rpm, feed 1mm)	0.110

From Table 4 it can be found that surface roughness values for all samples at different conditions. From figures [(10) and (11)] it can be remarked that surface roughness decreased for samples that treated with burnishing process. The lowest surface roughness obtained when the metal treated with (1 mm feed value and 1200 rpm speed value) burnishing process that its value is (0.110  $\mu\text{m}$ ). This result obtained because in burnishing process the material near a machined surface is displaced from peaks to fill valleys of the surface profile (according to Zabkar, B. and Kopač, J. [16]).



**Fig. 10. Influence feed values of burnishing process on surface roughness of the samples.**

Figure (10) explained that the surface roughness decreased with increase of feed values in burnishing process for used specimens. The lowest value of the surface roughness obtained when feed value was (1) mm, at constant speed value which was (370) rpm, which was (0.207)  $\mu\text{m}$  this is due to the material near a machined surface is displaced from peaks to fill valleys of surface profile during this burnishing process (according to Malleswara Rao J. N. et al [7]).



**Fig. 11. Influence speed values of burnishing process on surface roughness of the samples.**

Figure (11) showed that the surface roughness decreased with increase of speed values in burnishing process for used specimens. The lowest value of the surface roughness obtained when the speed value was (1200) rpm, at constant feed value which was (1) mm, which was (0.110)  $\mu\text{m}$  this is due to the material near a machined surface is displaced from peaks to fill valleys of the surface profile during this burnishing process

causing better surface fineness (according to Malleswara Rao J. N. et al [7]).

## 5. Conclusions

The improvement of the mechanical properties of low carbon steel AISA 1008 by using burnishing process yielded the following conclusions:

1. Increasing feed value of burnishing process led to improve fatigue limit. The highest value of fatigue limit (119.5 Mpa) was obtained at (1mm) feed and (370rpm) constant speed of burnishing process.
2. Increasing speed value of burnishing process led to improve fatigue limit. The highest value of fatigue limit(169 Mpa) was obtained from (1200 rpm) speed and (1 mm) constant feed of burnishing process which was
3. Increasing feed value of burnishing process led to increase hardness value. The highest value of hardness (212.2 HVN) was obtained from (1mm) feed and (370rpm) constant speed of burnishing process.
4. Increasing speed value of burnishing process led to increase hardness value. The highest value of hardness (220.13 HVN) was obtained from (1200 rpm) speed and (1 mm) constant feed of burnishing process.
5. Increasing feed value of burnishing process led to decrease surface roughness value. The lowest value of surface roughness (0.207  $\mu\text{m}$ ) was obtained from (1mm) feed and (370rpm) constant speed of burnishing process.
6. Increasing speed value of burnishing process led to decrease surface roughness value. The lowest value of surface roughness (0.110  $\mu\text{m}$ ) was obtained from (1200 rpm) speed and (1 mm) constant feed of burnishing process.

## 6. References

- [1]Terentjev, V.F. "Fatigue of Metallic Materials", Moscow, Russia, 2002.
- [2]John.V.B., "Introduction to Engineering Materials ", International Journal of Scientific and Research Publications, Volume 4, London, 1985.
- [3]Zabkar, B., Kopač, J., "An Investigation into Roller Burnishing Process", Journal of production Engineering, volume 17, India, 2013.

- [4] Ghodake A. P. et al, "Effect of Burnishing Process on Behavior of Engineering Materials- a Review", Journal of Mechanical and Civil Engineering, volume 5, Nasik, India, 2013.
- [5] Gharbi F, Sghaier S, Hamdi H et al, "Ductility Improvement of Al 1050A Rolled Sheet by a Newly Designed Ball Burnishing Tool Device", International Journal Advance Manufacturing Technology 60:87–99, 2012.
- [6] Deepak Mahajan and Ravindra Tajane, "A Review on Ball Burnishing Process", International Journal of Scientific and Research Publications, Volume 3, 2013.
- [7] Malleswara Rao J. N. et al, "The Effect of Roller Burnishing on Surface Hardness and Surface Roughness on Mild Steel Specimens", International Journal of Applied Engineering Research, Volume 1, India, 2011.
- [8] Shashi Prakash Dwivedi et al, "Effects of Roller Burnishing Process Parameters on Surface Roughness of A356/5%SiC composite using Response Surface Methodology", 2014.
- [9] S. Thamizhmanii and S. Hassan, "an Experimental Work on Multi Roller Burnishing Process on Difficult to Cut Material – Titanium Alloy", International journal of Integrated Engineering, Malaysia, 2009.
- [10] Korzynski M, Lubas J, Swirad S et al, "Surface Layer Characteristics due to Slide Diamond Burnishing with a Cylindrical-Ended Tool", Journal Mater Process Technology, 2011.
- [11] Franzen V, Trompeter M, Brosius A et al, "Finishing of Thermally Sprayed Tool Coatings for Sheet Metal Forming Operations by Roller Burnishing", International Journal Mater, 2010.
- [12] Thamizhmanii S., Bin Omar B., Saparudin, S. and Hassan S., "Surface Roughness Investigation and Hardness by Burnishing on Titanium Alloy", Journal of Achievements in Materials and Manufacturing Engineering, 2008.
- [13] F.Gharbi, S. Sghaier, K. J. Al Fadhalah, and T. Benameur, "Effect of Ball Burnishing Process on the Surface Quality and Microstructure Properties of AISI 1010 Steel Plates", Journal Mater Process Technology, Volume 20, 2011.
- [14] Fang Jung Shiou, Chien Hua Chen, "Freeform Surface Finish of Plastic Injection Mold by Using Ball Burnishing Process", National Taiwan University of Science and Technology, Taipei, Taiwan, 2003.
- [15] U. M. Shirsat, B. B. Ahuja, "Parametric Analysis of Combined Turning and Ball Burnishing Process", International journal of engineering and material science, volume 11, 2004.
- [16] El-Axir MH "An Investigation into Roller Burnishing", International Journal Machine Tools Manufacturing, 2000.
- [17] J. Dossett and G.E. Totten, "ASM Handbook", volume 4A, Steel Heat Treating Fundamentals and Processes, ASM, 2013.
- [18] Hashemi, S., "Foundations of Materials Science and Engineering", 4th edition, 2006.

## الخواص الميكانيكية للصلب المصقول نوع AISI 1008

زياد دوشان كاظم\*

محمد عبد الرؤوف عبد الرزاق\*\*

وسن سهيل □ سين\*\*\*

\*\*\*قسم هندسة المواد/الجامعة المستنصرية/بغداد/العراق

\*\*قسم الهندسة الميكانيكية/الجامعة المستنصرية/بغداد/العراق

\*البريد الإلكتروني: [dr.zeyad@yahoo.com](mailto:dr.zeyad@yahoo.com)

\*\*البريد الإلكتروني: [mohammedraof415@yahoo.com](mailto:mohammedraof415@yahoo.com)

\*\*\*البريد الإلكتروني: [wassansona93@gmail.com](mailto:wassansona93@gmail.com)

### الخلاصة

الصلب يحسن مقاومة الكلال، الصلادة السطحية ويقال الخشونة السطحية للمعدن لأنه هذه العملية تحول اجهادات الشد المتبقية الى الاجهادات الضغطية المتبقية. أداة الصقل الأسطواني استخدمت في العمل الحالي على عينات الفولاذ منخفض الكربون نوع (AISI 1008). في هذا العمل، تجارب مختلفة أنجزت لدراسة تأثير عامل التغذية وعامل السرعة في عملية الصقل على مقاومة الكلال، الخشونة السطحية والصلادة السطحية لعينات الفولاذ منخفض الكربون نوع (AISI 1008). أول عامل مستخدم هو قيم التغذية التي كانت (٦, ٨, ١٠, ١٢) ملليمتر في سرعة ثابتة (٣٧٠) دورة/دقيقة، بينما ثاني عامل مستخدم هو قيم السرعة التي كانت (٥٤٠، ٨٠٠، ١٢٠٠) دورة/دقيقة في تغذية ثابتة (١) ملليمتر. نتائج اختبار الكلال توضح بأنه تم تحسين حد الكلال، حيث أعلى قيمة لحد الكلال تم الحصول عليها من العينات التي تمت معاملتها مع (١) ملليمتر قيمة التغذية، ١٢٠٠ دورة/دقيقة قيمة السرعة) في عملية الصقل والتي كانت (١٦٩) ميكا باسكال. من نتائج اختبار الصلادة نلاحظ ان زيادة قيم التغذية والسرعة يؤدي الى زيادة الصلادة لسطح المعدن. نتائج اختبار الخشونة السطحية، في هذا البحث، توضح ان عملية الصقل تقلل الخشونة السطحية بإنتاج انهاء سطحي دقيق وجيد على سطح المعدن حيث أفضل نعومة للمعدن يمكن الحصول عليها من (١) ملليمتر قيمة التغذية، ١٢٠٠ دورة/دقيقة قيمة السرعة) من عملية الصقل والتي هي (١٠, ١٠) مايكرومتر.