PAPER NAME

LOW CARBON STEEL WEARING PROPER TIES DUE TO PACK.pdf

AUTHOR

Petrus Sampelawang

WORD COUNT

2162 Words

CHARACTER COUNT

11487 Characters

PAGE COUNT

3 Pages

FILE SIZE

113.8KB

SUBMISSION DATE

Oct 10, 2024 3:44 PM GMT+8

REPORT DATE

Oct 10, 2024 3:44 PM GMT+8

16% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

- 16% Internet database
- 1% Publications database
- Crossref database
- Crossref Posted Content database

Excluded from Similarity Report

- Submitted Works database
- Bibliographic material
- Quoted material
- Cited material
- Abstract
- Methods and Materials
- Small Matches (Less then 15 words)
- Manually excluded sources

VOL. 15, NO. 9, MAY 2020 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

LOW CARBON STEEL WEARING PROPERTIES DUE TO PACK CARBURIZING WITH BUFFALO BONES CHARCOAL AS ENERGIZER

Nitha[1], Petrus Sampelawang[1], Yafet Bontong[1], Suri Toding Lembang[2] and Willy Yavet Tandirerung[3]
[1]Mechanical Engineering Department, Faculty of Engineering, Indonesia Christian University Toraja, Tana Toraja, Indonesia
[2]Mathematics Education Department, Faculty of Teacher Training and Education, Indonesia Christian University Toraja, Tana Toraja, Indonesia
[3]Agrotechnology Department, Faculty of Agriculture, Indonesia Christian University Toraja, Tana Toraja South Sulawesi, Indonesia
E-Mail: nithamaska@yahoo.com

ABSTRACT

This study aims to determine the effect of buffalo bone charcoal as an energizer to low carbon steel wear with a mesh size of 30 heating temperature of 950^{0}C. Buffalo bone charcoal used in mesh size 30, volume percentage of buffalo bone char and Barium Carbonate 60% ATK + 40% $BaCO_3$, 70% ATK + 30% $BaCO_3$, 80% ATK + 20% $BaCO_3$ heated in furnace at temperature 950^{0}C used for source carbon in low carbon steel to determine the effect of carburizing pack process on low carbon steel wear. The results showed that the highest wear of low carbon steel mesh 30 at heating temperature 950^{0}C with the volume percentage of buffalo and Barium Carbonate 80% ATK + 20% $BaCO_3$ ie 0.00062013 gram/s.

Keywords: buffalo bone charcoal, low carbon steel, wear, mesh 30, pack carburizing, heating temperature 950^{0}C.

INTRODUCTION

Carburizing Pack method is one method to improve mechanical properties of carbon steel lace that is hardness value and value of tensile strength of low carbon steel at surface. In this process the low carbon steel remains strong and resilient at the stadium. This study aims to determine the effect of carburizing media with the percentage variation of bone powder of buffalo bones as carbon in carburizing process to mechanical properties of low carbon steel. The temperature used in the carburizing process lasts is 900 ^{0}C with a holding time of 60 minutes. This research results show that the percentage of buffalo bone charcoal powder as a medium in the method of carburizing pack can improve the mechanical properties of hardness and tensile strength of low carbon steel.(Bontong, Syam, Arsyad, Asmal, & Nitha, 2018).

LITERATURE REVIEW

Wear is defined as progressively losing substance from the operating surface of a relative motion of the body from the surface to another object. Wear is broadly grouped into abrasivewear, adhesive wear, corrosive wear and surface fatique (Rabinowicz, 1995).

Wear and tear is the dominant cause of loss of function of machine hence need effort to improve mechanical properties of metal especially wear resistance, including through surface hardening. According to Bataev (1996), with increasing hardness of steel specimens obtained through heat treatment methods the wear rate will decrease. Sorokin (1996) shows that carbon content has a great effect on the wear resistance of steel. This is explained by tempering the low temperature of the steel with the martensite structure will increase the wear resistance of steels in line with the increase in carbon content. The wear resistance increases with increasing metal strength and decreases as the metal viscosity diminishes. Different grades of steel having the same tensile strength, yield point, or shear strength, have different wear resistance. This shows that single mechanical characteristics can not be the main criterion for material wear resistance.

Abrasive wear arises when a hard, rough surface slips on a soft surface, piercing inward and producing grooves. The material may be lost in fragments or else the material forms a pair of piles along each groove. The material in the pile is then easy to escape from the surface. Abrasive wear includes both the moving particles on the surface (two body abrassion) and the hard particles moving over two moving surfaces (three body abrassion).

Adhesive wear occurs when a material is difficult to move on another surface or to squeeze another surface. The material is lost in the form of small particles that are usually transferred to other surfaces but can also be lost apart. The inclination of the contact surface is attached, arising from the tensile force present between the atomic surfaces of the two materials. If two surfaces move together and then separate, normally and tangentially the tensile forces are working to pull material from one surface to another. When the material moves from the surface of origin, the fragment of adhesive wear is formed. Surface fatique occurs on two fringing surface planes. The resultant contact causes the formation and growth of surface cracks which play an important role as the cause of loose surface of material or wear. Corrosive wear occurs in situations where the surrounding environment chemically interacts with the sliding surface.

One method of wear testing used is the method introduced by Bataev (1996) which is the interaction between the solid material (block) as a test object that is rubbed on a rotating disk coated abrasive paper. The wear rate in this test is expressed as a reduction in the mass or volume of the specimen after it has been rubbed (scour due to contact between the rotating disc and the specimen) each time unit expressed by:

ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

$$W = \frac{w}{s} \quad (\frac{mg}{sekon}) \qquad \text{...(1)}$$

with w : the weight of the missing material
s : total test time (seconds)

While the wear intensity is expressed by (Sofanov and Alexsenko, 1998).:

$$I = \frac{h_1}{L}(mg/meters) \qquad \text{.......................................(2)}$$

with h_1 : linear wear determined from changes in the mass of the specimen after the wear test(mg)
L : track path of swipe (meters)

Indonesia is a vast country with a considerable number of population, so the need for food is increasing. Buffalo is an animal that has the potential to be raised as panghasil milk and meat. The consumption of buffalo meat especially in Riau province from the last three years has always increased. Based on data from the Directorate General of Livestock (2013) stated that meat production in Riau from 2011, 2012 and 2013 is 1, 613 tons per year, increasing every year. As the need for buffalo meat increases the waste of buffalo bones produced. At this time the utilization of buffalo bone waste is limited as a craft so that the utilization has not been optimally. In response to this, another alternative is used as an adsorbent, the adsorbent is a substance that has binding properties on the surface and this characteristic is very prominent in porous solids (Sukardjo, 2002). According to Darmayanto (2009) the organic content of buffalo bones by 35%. Carbon content in the bone is quite a lot so it is possible to be used as raw material for making charcoal active.

Activated charcoal is an amorphous compound which can be produced from carbonaceous materials or from specially treated charcoal to obtain a wider surface. The surface area of activated charcoal ranges from 400 to 800 m^2/gram with a pore size between 5-10 A. Bone charcoal has a high absorption capacity because bone chars have large amounts of pores. Especially in Toraja waste buffalo bones have not been utilized and wasted, so potentially be a source of activated charcoal.

The carburizing process is a heat treatment process in which the heating and cooling processes of the metal are in a solid state to change the physical and mechanical properties of the metal. Through appropriate heat treatment, the internal stress can be reduced, the grain size can be enlarged or reduced, the toughness is increased or a hard surface is produced around the ductile core. To obtain harsh properties on the surface and ductile parts of the core of carbon steel, it is necessary to do case hardening one of them through pack carburizing process.

Steel of different carbon content by itself requires different heat treatment, given the critical temperature difference at different layers. During the long carburization process grain growth occurs in steel, therefore the steel needs to be heated to the core critical temperature, then cooled thereby obtaining the core with fine grains. The steel is then heated above the transformation temperature of the outer layer, then dyed to obtain a hard and smooth coating. Low carbon steels with levels of C = 0.15% are generally hardened by quenching, which during the carburization process at certain temperatures and at times the level of the outer layer of carbon can increase from 0.9 - 1.2% C.

MATERIALS AND METHODS

The research was conducted in January 2019. The place of this research was conducted in Physical Metallurgical Laboratory, Mechanical Technology Laboratory Department of Mechanical Engineering, Faculty of Engineering, Hasanuddin University, Makassar.

The material used is a low carbon steel with a wear test made in accordance with the standard ASTM E-466, buffalo bone char from before being firstly refined to a fineness level of mesh 30, Barium carbonate ($BaCO_3$). The tool used is kitchen furnace, carburation steel box made of steel plate 5 mm with resistance to temperature up to 1500^0C, wear test machine, sandpaper with 120 grit roughness up to 2000 grit, polishing tool, autosol and receipt, digital with an accuracy of 1 mg, a miser to flatten the surface of the material, a saw to cut the material, spring scales. Preparation of low carbon steel specimens for wear test before pack carburizing process. Testing of low carbon steel specimens wear test after pack carburizing process.

RESULTS AND DISCUSSIONS

The wear test is performed on low carbon steel material with heating temperature of 950^0C with mesh size of buffalo bone charcoal 30 and volume percentage of 60% ATK + 40% $BaCO_3$, 70% ATK + 30% $BaCO_3$, 80% ATK + 20% $BaCO_3$ is obtained as follows:

Table-1. Table wear test of low carbon steel pack carburizing with buffalo bone charcoal.

heating temperature (^{0}C)	mesh size (mesh)	Volume of percentage (%)	Specimen	Weight loss (gram)	Wear rate (gram/sec)	Average wear (gram/sec)
950^0C	Mesh 30	Normal	W_1	0,032362	0,0010787	0,0020222
			W_2	0,059331	0,0019777	
			W_3	0,0903	0,00301000	
		60%ATK+40%$BaCO_3$	W_1	0,012692	0,0004231	0,0008743
			W_2	0,025384	0,0008461	
			W_3	0,040615	0,0013538	
		70%ATK+30%$BaCO_3$	W_1	0,01003	0,0003343	0,0007354
			W_2	0,02206	0,0007353	
			W_3	0,034096	0,0011365	
		80%ATK+20%$BaCO_3$	W_1	0,008034	0,0002678	0,00062013
			W_2	0,019069	0,0006356	
			W_3	0,02871	0,000957	

Based on the above table can be described in graphical form in the following Figure-1.

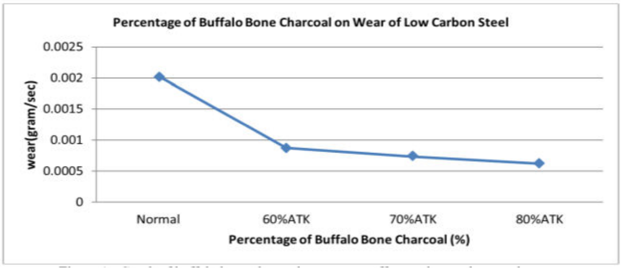

Figure-1. Graph of buffalo bone charcoal percentage effect on low carbon steel wear.

From the graph above it is found that there is a decrease in wear where the volume percentage and grain size of charcoal affect the wear of low carbon steel. The greater the volume of charcoal percentage, the decreasing wear value means increased wear resistance and greatest wear resistance on mesh grain size 30, heating temperature 950^0C, with volume percentage of buffalo bone bone 80% ATK + 20% $BaCO_3$.

CONCLUSIONS

Pack carburizing process with buffalo bone char from effect to low carbon steel wear where the bigger volume of buffalo bone volume and the smaller grain size then the wear rate decreasing means the wear resistance is increasing and vice versa.

REFERENCES

ASTM. 2000. Standard Test Method for Vickers Hardness of Metallic Materials. West Conshohocken, United States: PA 19428-2959.

Bataev A. A., dan Tushinskii, L. I,.1996. Effect of the Ferrite-Cementit Structure on the Rate of Abrasion Wear in Steel, Metal Science and Heat Treatment. 38: (1-2): 262-264.

Bontong Y., Syam R., Arsyad H., Asmal H. S. & Nitha. 2018. Behavior of Pack Carburizing With Bone Buffalo Charcoal And BaCo3 Against Mechanical Properties Of Low Carbon Steel. 13(14): 8.

Darmayanto. 2009. Use of Chicken Bone Powder as a Decrease in the Color Intensity of Peat Water, Thesis, University of North Sumatra, Medan.

D. Fatai Olufemi at al. 2010. Pack carburized of Mild Steel, using Pulverized Bone as Carburizer Optimizing Proscess Parameters, Univrsity of technologi PMB 704,Akure, ondo state Negeria. Journal of Practices and Tecnologies. 1583-1078, pp. 1-12.

Genel K. and Demirkol M. 1999. Effect of Case Depth on Fatigue Performance of AISI 8620 Carburized Steel. Gu¨mu¨ssuyu 80191, Istanbul, Turkey: International Journal of.

M. Preciado. et al. 2006. Effect of low tempering prior cryogenic treadment on carburized steels. Department of Civil Engineering, University of Burgos, Av. Cantabria s/n, 09006 Burgos, Spain. Journal of materials processing technologi. 176(2006): 41-44.

Paul Aondona Ihom. 2013. Case Hardening of Mild Steel Using Cowbone as Energizer., African journal of Engineering research. African Journal of Engineering Research. 1(4): 97-101.

Rabinowicz E. 1995. Friction and Wear of Material. John Willey & Sons, Inc., Singapore. Shackelford, J.F. 1996. Introduction to Material Science for Engineering, Edisi ke empat. New Jersey : Prentice Hall Inc.

Sofanov A. N., and Aleksenko, S. I., 1998, Effect of Laser Treatment on The Wear Resistance of Steel, Metal Science and Heat Treatment. 40:(9-10),: 399-401.

Sorokin G. M., dan Bobrov S. N. 1998. Fundamental Principles for Choosing Steels on the Basis of Result of Wear Test, Metal Science and Heat Treatment. 40:(1-2),: 76-78.

Suryanto H., Malau V., Samsudin. 2003. Effect of Addition of Barium Carbonate on Carburizing Media Against Characteristics of Hardness of Low Carbon Steel Carburizing Layers. Proceedings of the National Seminar on Mechanical Engineering, Brawijaya University.

Sukardjo, 2002, Chemistry physics, Jakarta, Bineka Cipta.

16% Overall Similarity

Top sources found in the following databases:

- 16% Internet database
- 1% Publications database
- Crossref database
- Crossref Posted Content database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	scholar.unhas.ac.id Internet	5%
2	repository.petra.ac.id Internet	4%
3	cot.unhas.ac.id Internet	4%
4	dspace.itu.edu.tr Internet	1%
5	arpnjournals.com Internet	1%
6	atlantis-press.com Internet	<1%

Excluded from Similarity Report

- Submitted Works database
- Quoted material
- Abstract
- Small Matches (Less then 15 words)
- Bibliographic material
- Cited material
- Methods and Materials
- Manually excluded sources

EXCLUDED SOURCES

arpnjournals.org Internet	69%
arpnjournals.org Internet	68%
Website repository.ukitoraja.ac.id Internet	4%