The Formation of Machine Components Using Powder Metallurgy Method Utilizing Metal Powder From Grinding Process

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ABSTRACT
Powder metallurgy is a metal working technology in which parts or components are produced from metal powders. The working process is that the metal powder is pressed into the desired shape. The formation of technical materials using powder from machining is still being developed. In this research, the writer will conduct research using the powder from the results of the sensing to be used as a component of machinery or other forms. In this research, the stages of resistance include: powder drying, mixing, sieving, forming (packing), and heating (Sinterung). The compacting process is carried out with a compacting pressure of 20 KN, 25 KN and 30 KN, and by heating in an electric kitchen with a temperature of 1000◦C with 1 hour of detention and cooling for 24 hours in the kitchen. the compacting pressure (P) of 20 KN of 83.19 kg / mm2 experienced an increase in hardness of 4.18% for the 25 KN compacting pressure and for the 30 KN compacting pressure, a significant increase in the compacting pressure (P) of 20 KN which was 94, 41 or 11.88%. The hardness of the test specimen decreased to the original material (Steel) of the test specimen, namely 110.62 kg / mm2, this could occur due to the influence of the mixture of powder and material from grinding stone. 94.41 kg / mm2, this occurs because of the mixing of the original material with the grinding stone during the grinding process.

Keywords: *Compaction 1, Powder Metallurgy 2*

1. INTRODUCTION

Utilization of scrap metal (grower) for commercial metal products using powder metallurgy technique continues to be developed and researched. This is because the powder metallurgy technique is easier to form, the process energy used is relatively low, reduces machining costs, the final product can be adjusted directly to the desired dimensions [1].

Several researchers have developed the technique to investigate the properties of metal products using different raw materials [2] have reported that the physical and mechanical properties of low alloy steels resulting from powder metallurgy are improved, due to the binding of particles

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Several researchers have developed these techniques to investigate the properties of metal products using different raw materials [2] have reported that the physical and mechanical properties of low alloy steels (low alloy steels) resulting from powder metallurgy are increased, due to the binding of fine particles to the steel occurs. at temperatures below the critical temperature. [3] reported that the alloy product of cobalt (Co) and tungsten (W) with the addition of graphite through a powder metallurgy process can improve the bonding of particles and the quality of metal bearings. [4] investigated the effect of temperature and sintering resistance time on the hardness properties of the metal matric composite of tungsten (W) -cuprum (Cu) through a powder metallurgy process. They reported that the highest hardness of 34.7 HBN was obtained at temperature and sintering time of 900 ° C, respectively

and 2 hours, and the highest compressive strength of 156.71 MPa at temperature and sintering time of 800 ° C and 3 hours, respectively. Meanwhile, Mustika et al. (2011) have made composites from cast AC8A flakes as matrices and SiC ceramic particles as reinforcement using the powder metallurgy method by hot pressing. They reported that the hardness and compressive strength of ACS8 / SiCP were higher than that of cast AC8A ingots. These previous studies indicate that the development of investigations related to the hardness of scrap metal with Al / Cu / SiC alloys has not been investigated.

2. METHODS

The development of technological advances also encourages the need for materials that have the desired properties. Materials, especially metal, which are often used in modern equipment where most modern tools require materials with high mechanical properties such as tensile strength, hardness, ductility, and have high corrosion resistance.

One method of forming equipment components that is non-conventional machining is powder metallurgy method.

The main material for making grinding stones consists of the elements of grinding materials (abrasives) and adhesives (bonds). Commonly used abrasives include aluminum oxide, silicon carbide, boron nitride and diamond.

The material used in this study was a mixture of Al, Cu, and SiC powders at 80%, 15%, and 5% (wt%), respectively. The sizes of the Al, Cu, and SiC powders were 12 µm. In this process, Al, Cu, and SiC powders are weighed and mixed according to a predetermined composition ratio using a magnetic stirrer for 30 minutes with a wet mixing technique [5], this is due to the difference in density of the three materials used. Before being subjected to pressure (with a fixed load of 5000 kg) at room temperature, the mold of the specimen is given zinc stearate (as a lubricant), this is intended to make it easier for the specimen to be removed from the mold. Furthermore, the test specimens are heated (sintered) in an oven with different temperatures, namely: 320oC, 420oC, and 520oC for 40 minutes, then followed by air cooling.

3. RESULTS AND DISCUSSION

Specimen hardness testing was carried out by the Brinell method. Prior to the hardness test, the specimens were smoothed using a polishing machine on rubbing paper / sandpaper with grades 350, 500, 800, and 1000 respectively. indentor sphere with a diameter of 2.5 mm indented three points on each specimen.

3.1 Mixing and sieving powder from the results of the sensing for Steel material

Figure 1 Filtering of the powder from the sensing

3.2 Compacting

The compaction was carried out with a pressure (P) of 20 KN, 25 KN and 30 KN with 5 specimens each

Figure 2 Powder compaction

3.3. Sintering

The sintering process is carried out at the Sriwijaya State Polytechnic Mechanical Laboratory using an electric kitchen at a temperature of 1000◦C and held for 1 hour by cooling in the kitchen for 24 hours

Pigure 3 Sintering Process

3.4. Brinnel Hardness Test

Hardness testing using the Brinnel method with a spherical indenter with a diameter of 2.5

Figure 4 Hardnes Testing

Table 1. Brinnel hardness test with F 62.5 kg Ball diameter 2.5

No	material	Diameter Indentor (D.mm)	P (Kg)	d (mm)	dr (mm)	material Kg/mm^2
1	Steel P kompaksi 20 KN	2,5	62,5	d_1:0,999 d_2:0,958	0,978	79,62
2		2,5	62,5	d_1:1,163 d_2:1,109	1,136	58,99
3		2,5	62,5	d_1:0,890 d_2:0,922	0,906	93,98
4		2,5	62,5	d_1:0,851 d_2:0,884	0,867	99,52
5		2,5	62,5	d_1:0,934 d_2:0,982	0,958	83,84
						83,19
1	Steel P kompaksi 25 KN	2,5	62,5	d_1:0,883 d_2:0,840	0,862	104,14
2		2,5	62,5	d_1:0,971 d_2:0,970	0,971	80,85
3		2,5	62,5	d 1 :0,943 d 2 :0,945	0,944	83,89
4		2,5	62,5	d 1 0,973 d 2 :0,975	0,974	79,61
5		2,5	62,5	d_1:0,880 d_2:1,012	0,946	85,61
						86,82
1	Steel P kompaksi 30 KN	2,5	62,5	d_1:0,904 d_2: 0,922	0,913	92,05
2		2,5	62,5	d 1 :0,880 d 2 0,884	0,882	98,97
3		2,5	62,5	d 1 :0,914 d 2 0,930	0,922	90,45
4		2,5	62,5	d 1 :0,942 d 2 :0,946	0,944	85,62
5		2,5	62,5	d 1 0,853 d 2 :0,857	0,855	104,95
						94,41
1	Steel	2,5	62,5	d_1:0,837 d_2: 0,833	0,835	110,62
2		2,5	62,5	d_1:0,836 D_2:0,832	0,834	110,62
						110,62

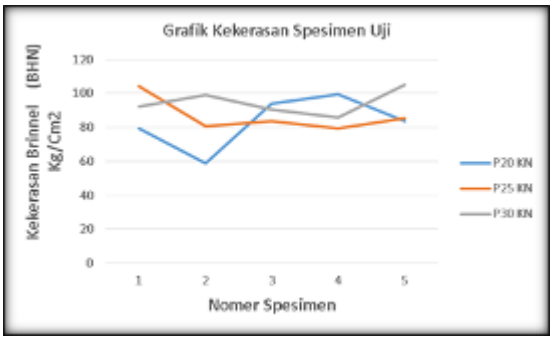

Figure 5 Graph of Brinnel hardness test results

3.5. Analysis of Test results

From Table 1 and Figure 5 above, it can be concluded that the process of compacting and sintering can affect the mechanical properties, especially the hardness of the test specimen. From the results of the Brinnel test with F 62.5 kg ball diameter 2.5 and detention for 15 seconds the average hardness for compacting pressure (P) 20 KN was 83.19 kg / mm2.4.18% .. at a compacting pressure of 25 KN and for a compacting pressure of 30 KN, there was a significant increase in the compacting pressure (P) of 20 KN, which was 94.41 or 11.88%. The hardness of the test specimen decreased in the original material (Steel) of the test specimen, namely 110.62 kg / mm2, this could occur due to the influence of the mixture of powder and material from the grinding stone. 94.41 kg / mm2, this happened because of the mixing of the original material and the grinding stone during the grinding process.

4. CONCLUSION

The compacting pressure on the material affects the thickness size of the test specimen. We can see the difference in this, such as there is a pressure of 20 KN, 25 KN and 30 KN. The percentage increase in the average thickness at a compacting pressure of 30 KN has the smallest increase in accuracy of 4.8%.

1. Sintering process with 30 KN compacting has the highest level of hardness compared to P compacting 20 and 25 KN, namely with Brinnel hardness 94.41 kg / mm2

2. There was a decrease in material hardness against the initial material by 110.62 kg / mm2 at P 20 KN to 83.19. P 25 KN becomes 86.82 and at P30 KN becomes.

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