

Analysis Characteristics of Silicon Aluminum Material based on Fracture Period in Torque Test

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Abstract: Aluminum casting results are still many that suffered damage. Some of the causes are the lack of permeability and print strength. This research was expected to be able to know the capability of casting product to impact load from various temperature which was measured and expected to increase productivity of castings result. This research was expected to know the ability of casting product to the torque load of various forces that were measured and expected to increase the productivity of the castings. This research used variation of permeability value by testing 3 material tested with the same length and diameter. This study was conducted by observing the effect of corner and force of torque on the breaking strength performed by torque testing with the first test of the force of 4.6 ton with the angle 2° with the fracture period at 70° with the corner 0 ton, test the two force of 4.6 ton with corner 2° with fracture at 0 ton with corner 70°, third test of force 3 ton with corner 2° with fracture period at 76 ton with corner 0°.

1 INTRODUCTION

One of the composite-based materials is Al-SiC (Aluminum Silicon Carbide) because this material has a hard and light properties. Aluminum (Al) is as the matrix (main material) and SiC as its amplifier. Aluminum has advantages that have a lightweight, corrosion resistance and composite brakes are not having the sale value of the material is not economical anti theft. Metal Aluminum, when viewed from mechanical properties, such as hardness value (hardness), is very low. Therefore, Aluminum metal as a material has many weaknesses, especially mechanical strength, stiffness and coefficient of expansion. The advantages of Aluminum metal include light weight, corrosion resistant and easily formed (Zhongliang Shi et al. 2001). One way to increase the metal hardness is to strengthen the metal in a way coupled with hard materials, such as ceramic materials. The most commonly used and hardest ceramic type is the SiC

This research performs characteristic of making Al-SiC by stir casting method, with modification of

reinforcing fraction. Variations of addition strengthening parameters are 5, 10 and 15% SiC. The subjects covered include chemical composition with various material composition, tensile and impact test. The expected output from this research is the result of tensile strength and impact price. The use of brake blocks for railway canvas in Indonesia commonly used is made from cast iron, where this material has been started since the last decade. Brake block material using cast iron weighs 11 kg, making it difficult to install or installation cost is large enough. One of the efforts that has been taken is to combine the two constituent materials, namely matrix and amplifier called composite.

Composite materials include: resin, fiber and filler. The types of materials for railway brake blocks are gray cast iron and Al-SiC. The composite is a blend of selected ingredients based on the combination of physical properties of each constituent material to produce new and unique materials. Various kinds of amplifiers eg SiC and Al₂O₃. Based on the matrix material used, the composite can be classified into 3 groups, namely: metal matrix composite (MMC) as matrix, polymer

matrix composite (PMC) polymer as matrix, and ceramic matrix composite (Ceramic Matrix Compositor/ CMC) ceramics as matrix. While based on the type of reinforcement, the composite material can be explained as follows: particulate composite, amplifier in the form of particles, fiber composite, fiber-strengthening and structural composite, composite materials.

2 RESEARCH METHODS

This research was conducted in February 2017 at the Basic Physics Laboratory, Laboratory Faculty of Engineering Mechanical, Engineering Study Program, University of Harapan Medan, as for the procedural Implementation of research as below:

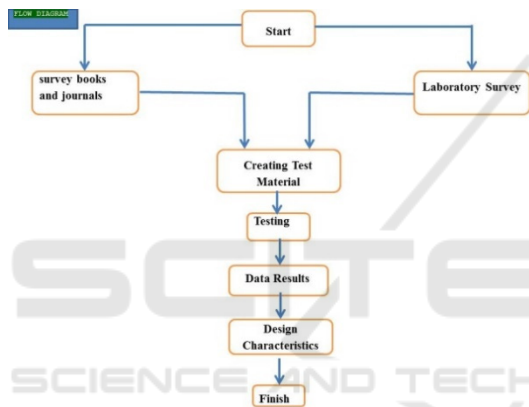


Figure 1: Procedure Implementation of Research.



Figure 2: Profile Materials.

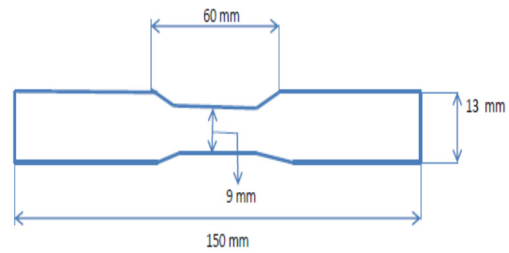


Figure 3: Size of Test Object.

3 RESULTS AND DISCUSSION

The research conducted using torque testing. Testing torsion used Torsion Machine torque test equipment. The Aluminum Silicon Carbide specimen, the maximum force applied to the torque testing apparatus was 4.6 N while the 5%, 10% and 15% Al-SiC specimens and Al-SiC composites with the maximum force of 76 N. The result of the torque test was the amount of broken force that could be seen in the tool with a percentage scale of the maximum force applied to the specimen. Torque testing by measuring the angle of the material was against the shock load, using the Charp method.

Table1: Research Results on Materials 1.

No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton
1	2	4,6	11	22	22,4	21	42	26,2	31	62	1,4
2	4	11	12	24	22,8	22	44	26,4	32	64	0,4
3	6	15,2	13	26	23,2	23	46	26,6	33	66	0,2
4	8	17,2	14	28	23,6	24	48	26,8	34	68	0,2
5	10	18,2	15	30	24,2	25	50	27	35	70	0
6	12	19,2	16	32	24,6	26	52	27,4			
7	14	20	17	34	25	27	54	27,6			
8	16	20,6	18	36	25,4	28	56	27,8			
9	18	21	19	38	25,8	29	58	27,8			
10	20	21,6	20	40	26	30	60	28			

Table 2: Research Results on Materials 2.

No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton
1	2	4,6	11	22	22,4	21	42	25,6	31	62	21,8
2	4	11	12	24	22,8	22	44	26,6	32	64	4,4
3	6	15,2	13	26	23,2	23	46	26,6	33	66	1,4
4	8	17,2	14	28	23,6	24	48	25,4	34	68	1
5	10	18,2	15	30	24,2	25	50	25,6	35	70	0
6	12	19,2	16	32	24,6	26	52	24			
7	14	20	17	34	25	27	54	24,4			
8	16	20,6	18	36	25,4	28	56	23,8			
9	18	21	19	38	25,8	29	58	23,4			
10	20	21,6	20	40	25,4	30	60	22,6			

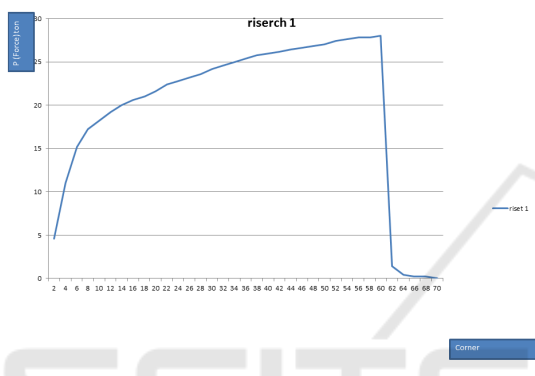


Figure 4: Material Characteristics in Experiment 1.

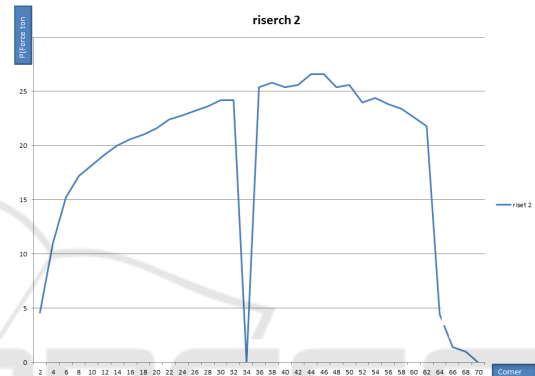


Figure 5: Material Characteristics in Experiment 2.

Table 3: Research Results on Materials 3.

No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton	No	Θ Corner	P (Force) ton
1	2	3	12	24	18,6	23	46	24,8	34	68	27,8
2	4	6,6	13	26	19,4	24	48	25,2	35	70	1,4
3	6	9	14	28	20	25	50	25,4	36	72	1,2
4	8	11	15	30	20,6	26	52	25,8	37	74	1
5	10	12,4	16	32	21	27	54	26,2	38	76	0
6	12	13,4	17	34	21,6	28	56	26,6			
7	14	14,4	18	36	22,2	29	58	26,8			
8	16	15,6	19	38	22,8	30	60	27			
9	18	16,4	20	40	23,2	31	62	27,4			
10	20	17,2	21	42	23,6	32	64	27,4			
11	22	18	22	44	24	33	66	27,6			

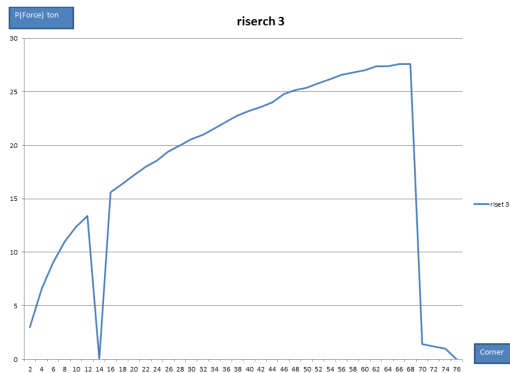


Figure 6: Material Characteristics in Experiment 3.

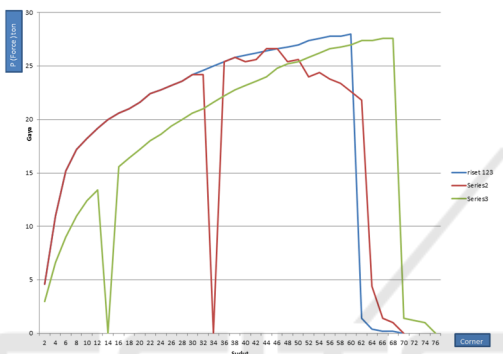


Figure 7: Collect Characteristics of Materials in Experiment 1, 2, 3.

4 CONCLUSIONS AND SUGGESTIONS

4.1 Conclusion

1. For test experiment 1, it shows the beginning of torque at corner 20 with a force of 4.6 tons, there is a fracture mass on. 700 angles with Force $P = 0$ ton.
2. For the experimental test, it shows the beginning of torque at a corner of 20 with a force of 4.6 tons, there is a fracture mass on. 700 corners with Force $P = 0$ ton, but at the force of approximately 25 ton with corner 340. almost happened stress.
3. For the experimental test, it shows the beginning of torque at corner 20 with a force of 3 tons, there is a fracture mass on. corner 760 with Force $P = 0$ tons, but at a force of approximately 170 N with an angle of 140 is almost stressful

4.2 Suggestion

1. For the execution of testing, it is required that the torsion test equipment be calibrated so that the tested results obtain valid data results.
2. The material of the test object shall be finished and the surface for clamping the standard for clamping, so as not to be detached from the holder.
3. Characteristic planning tools should be valid in data searched.

REFERENCES

- A. Y. junaidi, dharmawati, "Analysis Cutting Tool High Speed Steel (HSS) With Cast Iron Material From Universal Lathe," in *IRSTC 2015 PROCEEDING*, 2015, pp. 464–477.
- Indra Roza Junaidi, weriono, "Irrigation Water Debit Analysis that will be used on Micro Power Plant in SEI . Rampah Sub-District of Serdang Bedagai Regency," *Int. J. Innov. Sci. Res. Technol.*, vol. 3, no. 1, 2018.
- Indra Roza Junaidi, weriono, "Process Analysis of High Speed Steel Cutting Calculation (HSS) with S45 C Material On Universal Machine Tool," *IJISRT (International J. Innov. Sci. Res. Technol.)*, vol. 3, no. 1, pp. 447–456, 2018.
- Junaidi, "Analyze cutting tools (HSS) with cast iron material on Universal Lathes," in *Makalah PEKAN ILMIAH Periode XXII-TA.2014/2015 FAKULTAS TEKNIK UISU*, 2015, pp. 51–58.
- Junaidi, "The Effect of Exposure time on the Crack Length of Austenite AISI 304,316 and 316L Stainless Steel Material with Failure Stress Corrosion Cracking," in *WAHANA INOVASI Jurnal Penelitian dan Pengabdian*, 2013, pp. 291–298.
- Junaidi and Eddy, "Analysis of Cutting Carbide Tools with S45C Material on Universal Lathes," in *Seminar Nasional FT.UISU*, 2017, pp. 116–123.
- J. Budi Santri Kusuma, "Analysis of the effect of cooling media and heating on hardness and microstructure in the tempering process of SKD 11 tool steel.," *PROSIDING Seminar Nasional Pembangunan Berkelanjutan Bangsa Berbasis Iptek (PB3I-ITM). BIRO PUBLIKASI DAN DOKUMENTASI -ITM jLN.Gedung Arca No.52 Medan, MEDAN*, pp. 63–67, 2014.
- J. Junaidi, S. Hestukoro, A. Yanie, J. Jumadi, and E. Eddy, "IMPLEMENTATION ANALYSIS of CUTTING TOOL CARBIDE with CAST IRON MATERIAL S45 C on UNIVERSAL LATHE," in *Journal of Physics: Conference Series*, 2017, vol. 930, no. 1.
- J. Weriono, "Noise Analysis of Variations in Engine Turn on 1300 CC Cars Due to Mechanical Vibration," *J. Technol. Harapan*, vol. 6, no. 1, pp. 7–10, 2017.
- S. H. junaidi, weriono, indra roza, "Economic Planning

Analysis of MHP PLTMH Using Pico-hydro Turbine: Hundreds of watts - 5 KW,” *IJISRT (International J. Innov. Sci. Res. Technol.*, vol. 3, no. 2, pp. 112–116, 2018.

- T. Siagian, I. Siregar, and H. Lubis, “Characteristics of St.37 Steel Materials with Temperature and Time on Heat Treatment Test using Furnace,” 2018.

