Micro Structure And Low Steel Carbon Recovery After Machining With Annealing Heat Treatment

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Abstract. test aims to determine the carbon steel materials were in the process of *anhealing* after machining job. Where this test compares the process of heat treatment is given in a metal can affect the mechanical properties of the metal. One of the heat treatment process that can be given to the metal after the machining work is the process of annealing.process*Annealing* is a process of heat treatment of the metal by heating the metal at a certain temperature, holding at temperature and cooling the last few moments earlier metal with a very slow cooling rate. Heat treatment is given aiming to improve the mechanical properties of the metal. Air-ity it is carried out this study aimed to determine the effect inflicted on medium carbon steel after permesianan workmanship and undergo a process of *annealing* to violence and the resulting microstructure. This test is a test-sperimental oak. Materials used are carbon steels were given the treatment peekerjaan machining then *annealing* at various temperatures 650C, 700C and 850C with *holdingtime* 30 minutes. Further testing hardness and microstructure observation.The results of the data analysis menujinkan average hardness of specimens without the machining process and heat treatment was 71.74 *HRB* and microstructure obtained Perlite + Ferrite; The average hardness values of specimens with machining process is 75.02 *HRB* and microstructure obtained Perlite + Ferrite + Simentit; The average hardness values of specimens with machining and heat treatment process annealing 650^0C is 65.74 *HRB* and microstructure obtained Ferrite + Simentit; The average hardness values of specimens with machining and heat treatment process annealing 700^0C is 66.02 *HRB* and microstructure obtained Ferrite + Simentit; The average hardness values of specimens with machining and heat treatment process annealing 850^0C is 67.56 *HRB* and microstructure obtained Ferrite + Simentit.Keywords : Frais,*annealing*,Hardness test, microstructure, and Carbon Steel.

1. Introduction

In today's metal industry growing israpidly, it is caused by some aspect of the technology that supports it mainly processes and material technology. When examine dall human needs can not be separated from the metal element. Therefore, man seeks to improve the properties of physical and mechanical properties of metal. The process of treatment heaton the metalit isuse ful to improve the properties of the metal. To obtain the metal form fit the needs usually do Work turning, drilling, and many other machining that was done. In when the process of machining in an metals, metals are seen changes microstructure and mechanical properties of metals mendapatnkan engine work will greatly affect the remaining life during applied metal toughness will be after metal machine work done while the hardness value will increase and metalwill be more fragile. To cope with the mechanical properties of the metal must then restored of them is the method used by the heat annealingtreatment. Treatment heat treatment is done by heats the metal to a certain temperature "andthen cooled slowly inside thefurnace until the temperature in the furnace reaches room temperature.heat treatment Annealing will metalrestore the structure back as original.

2. Research Methodology

1). Preparation Initial Materials usedplates steel C 0.3% - 0.6% C; specimens cut to 5 with 4x4x1,5cm size. Tools that use: Rockwell hardness tester mitutoyo modelwishardHR-500, Metalurgical Microscope with brand OLYMPUS, oven (furnace) with brand WILMONN, Pliers Tweezers, PPE (Personal Protective Equipment), Machines Frais, Stingy, vise, sandpaper, Saws, medium carbon steel plate that has been done subsequent cutting is done machining reduced,uses milling machine(Milling)

to the amount difrais 4 pieces of plate. After the treatment process is carriedplate the heat annealing.for 30 minutes with temperature variations in the temperature of 650, 700, 850 oC.
2). Materials Testing Phase micro-structure with enlarged Tested 400 times, and tested carbon steel hardness with five points each sample pda violence. Using the eye ball test steel with dimensions of 1/16 eyes.

3. Results And Discussion

3.1 Hardness Testing

Hardness testing results Average: Rockwell hardness tester HR- mitutoyo Wishard model of 500.

Table 1. Hardness Testing Average Flat Steel Carbon

No	Test Objects	Hardness Value *Rockwell* (HRB)				
		TP	*PP*	*PP,A650,*	*PP A700*	*PP, A850*
1	Average	*71.74*	*75.02*	*65.74*	*66.02*	*67.56*

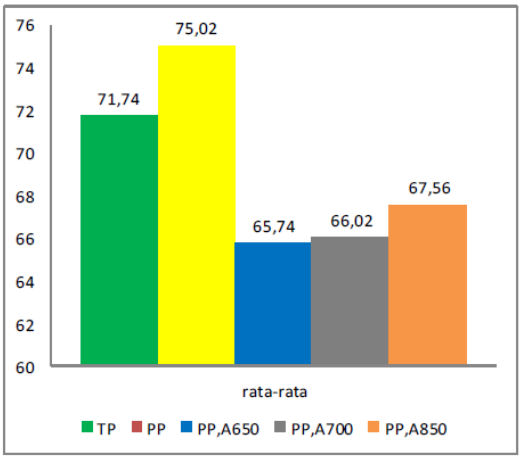

Figure 1. Average Carbon Steel hardness Testing

From the above table it is known that the average hardness of specimens without the machining process and heat treatment is 71.74 *HRB;*The average hardness values of specimens withmachining process is *HRB*75.02;The average hardness values of specimens with machining and heat treatment process annealing 650^{0}C is 65.74 *HRB;*The average hardness values of specimens with machining and heat treatment process annealing 700^{0}C is 66.02 *HRB;*The average hardness values of specimens with machining and heat treatment process annealing 850^{0}C is 67.56 HRB. Measurements *Rockwell* with an emphasisdiamond-shaped steel ball, is pressed into the material with a certain style for a certain time. Hardness *Rockwell* can be obtained directly read on a monitor machine. This proves that the influence of temperature differences on the results of the steel hardness. In a heat treatment process, after heating to temperatures which are determined and *holding time* to taste it doneslow cooling at a certain rate the change occurred mechanical properties and hardness was changed after becoming cold. Then a good recovery in violence is a heat treatment process annealing temperature of 850^{0}C with 67.56 HRB hardness. Warning: not doing violence to elevated temperatures low recovery because it would create software in the steel.

3.2 Testing microstructure

microstructure testing conducted with the aim of knowing the depth of the structure resulting from the process of heating and slow cooling phase is the phase of ferrite and pearlite.

1). Basic Materials (Without Machining and Heat Treatment Process Anneling)
medium carbon steel microstructure with specimen 1 as seen in the figure shows that the structure is formed, perlite (dark or black) and ferrite (light colored). Specimens 1 (raw material). This steel contains perlite that much, this steel hardness high enough. Steel base material (Without a Machining Process and Heat Treatment Anneling) has perlite and ferrite content.

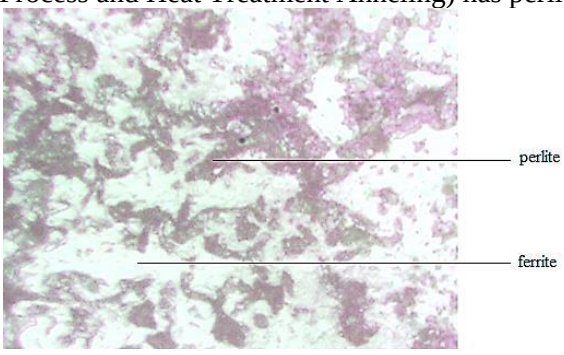

Figure 2. Material With Structural Perlite And Ferrite (Without Process Machining and Heat Treatment Anneling)

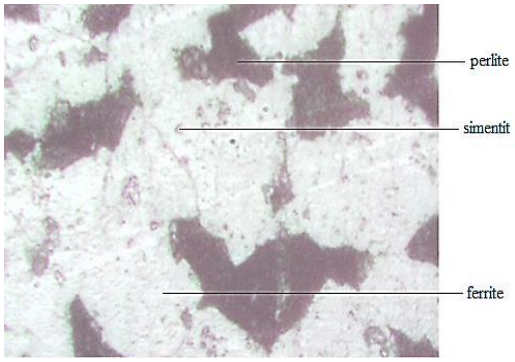

Figure 3. Process Machining With Structural Perlite + Simentit + Ferrite

2). By Process Machining
Microstructure of carbon steel being the specimen 2 as seen in the figure shows that the structure is formed, perlite (dark or black), cementite (form black dots in bright colors) and ferrite (light colored). In the machining process is a structure formed of ferrite + perlite + simentit. Cementite is iron with carbon compounds commonlyknown as iron carbide with chemical formula Fe_3C of the unit cell is orthorhombic and be violent. Ferrite form on slow cooling process. Perlite is a mixture of ferrite and sementite. In the picture shows the cooling rate is slow so formed are perlite and ferrite.
Due to the work piece is done machining then the resulting residual stresses in ferrite that much but there are simentit that a lot too.
3). By preoses machining and treatment
heatanneling 650^0C microstructure of carbon steel being the specimen 3 as seen in the figure shows that the structure is formed ferrite (bright). In the machining process and heat treatment anneling 650^0C gets slow cooling rate by air to room temperature then formed structure is ferrite. Ferrite form on slow cooling process of austenitic steel hipoetektoid when it reaches A3. This steel has a ferrite content of which many then it becomes soft steel of the specimen basenya. Steel with machining and heat treatment process anneling 650^0C contains ferrite.

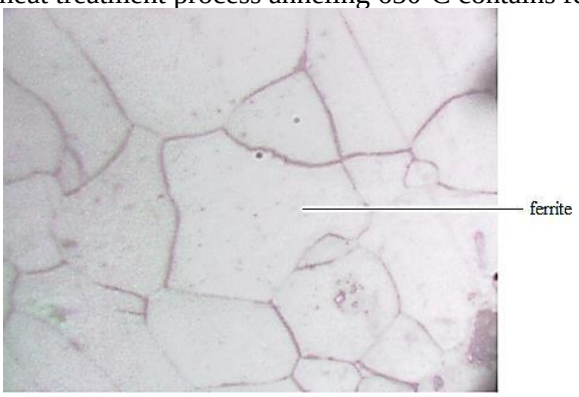

Figure 4. With Process Machining and Heat Treatment Anneling 650^0C. The Structure Ferrite

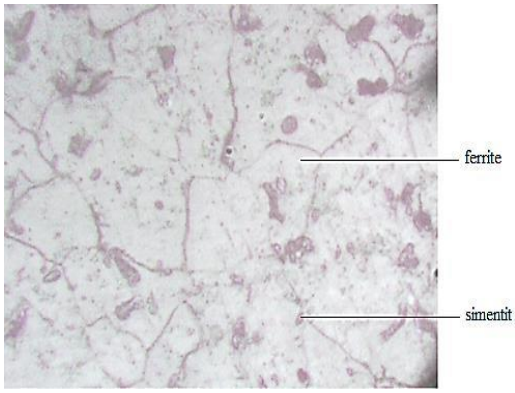

Figure 5. Process Machining and Heat Treatment Anneling 700^0C. The Structure Ferrite + Simentit.

4). By preoses machining andtreatment
Heatanneling 700^0C microstructure of carbon steel being the specimen 4 as seen in the figure shows that the structure is formed cementite (the sphere of black on bright colors) and ferrite (light colored).

In the machining process and heat treatment anneling 700^0C gets slow cooling rate by air to room temperature then formed structure is ferrite + simentit. Cementite is iron with carbon compounds commonly known as iron carbide with chemical formula Fe_3C of the unit cell is orthorhombic and be violent. Ferrite form on slow cooling process. This steel has a ferrite content that much but there are many additional simentit then it becomes harder steels of specimens anneal $650^{0.}$Steel with machining and heat treatment process anneling 700^0C contains simentit and ferrite.

5). With preoses machining andtreatment

Heatanneling 850^0C microstructure of carbon steel being the specimen 5 as seen in the figure shows that the structure is formed cementite (the sphere black the color of light) and ferrite (light colored). In the machining process and heat treatment anneling 850^0C gets slow cooling rate by air to room temperature then formed structure is ferrite + simentit. Cementite is iron with carbon compounds commonly known as iron carbide with chemical formula Fe_3C of the unit cell is orthorhombic and be violent. Ferrite form on slow cooling process. This steel has a ferrite content that much but there are many additional simentit then it becomes harder steels of specimens anneal $650^{0.}$the specimens anneal $700^{0.}$Steel with machining process andtreatment heatanneling850^0C contains simentit and ferrite. And of all the recovery annealing heat treatment which approached close to the steel structure without treatment is a heat treatment process annealing temperature of 850^0C.

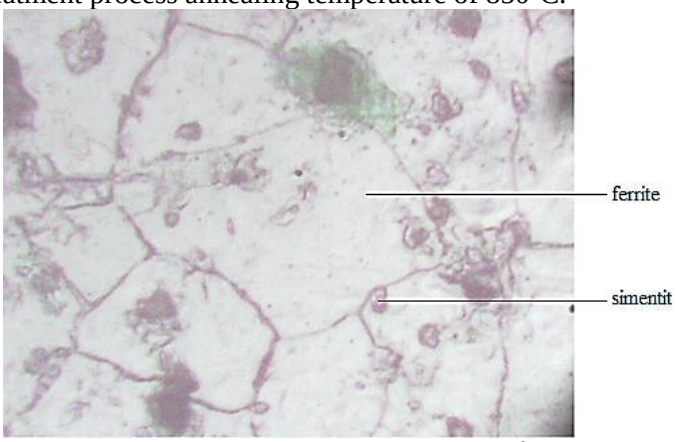

Figure 6. Machining and Heat Treatment Process Anneling 850^0C With Ferrite + Simentit Structural

5. Conclusion

Testing was conducted byhardness*RockwellhardnessTester*Mututoyo.examinationThe use of steel balls eye with eye dimension 1/16 "were recovered close to the steel hardness without treatment is with perosespemesianan and annealing heat treatment of 850 with 67.56 HRB hardness. Testing microstructure with Metalurgical Microscope with brand OLYMPUS who recovered close to the steel structure without treatment with perlite and ferrite content is perosespemesianan and annealing heat treatment of 850 with a content of ferrite and simentit. Seimentit nearly equal perlite.

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