

Microstructure and Roughness Analysis of Drum Brakes of Maruti 800

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Abstract: *The purpose of this paper focuses on the basic describing of drum brake systems in order to provide an in-depth microstructure analysis of the drum brake and also the roughness value of the drum surface as the roughness affects the braking capacity of linings on drum surface it also allows the duration of service of the drum This study will help because the study of wear will allow us to know the amount of wear on drum and to minimum roughness value of drum surface that is required to safe braking*

Keywords: Drum brakes, Maruti 800 Microstructure analysis, Roughness analysis, Tribological analysis

1. Introduction

A drum brake is a brake that presses the set of shoes or pads against a rotating drum called as brake drum this action causes friction which stops the vehicle.

Drum brake consists of the, wheel cylinder, brake drum, shoe, backing plate, and various springs and pins. In normal braking when the brakes are applied the brake fluid is pushed from master cylinder and to the wheel cylinders the piston pushes outwards an forces the brake linings on the brake drum surface which creates friction and reduces the speed of the vehicle and heat is generated that is dissipated. Emergency brakes are also drum brakes which are bypass for fluid action they are connected to hand brakes by means of steel cables it is fully mechanical for when brakes fail the cable stretch the lever which directly connected to shoes to stop in emergency Grey cast iron is used for the drum brakes as they have good Tribological properties and good at heat dissipation Brake lining are made up of asbestos material Reinforcements Binder Abrasives Friction Modifiers Filler Materials. the microstructure reveals the quality of the surface and the insight the microstructure helps us to check the current state of material at microscopic level and any changes can be noted for change the etchant are used for etching the surface to get a neat microstructure there are various types of etchants [4] Nital- 96–98 mL ethanol 2–4 mL nitric acid (HNO₃) , Picral,- 4 g picric acid ((NO₂)₃C₆H₂OH) 100 mL ethanol, Glyceregia-, 3 parts glycerine 2 parts hydrochloric acid (HCl) 1 part nitric acid (HNO₃), Alkaline sodium Picrate-, 2 g picric acid ((NO₂)₃C₆H₂OH) 25 g sodium hydroxide (NaOH) 100 mL distilled water, Klemm I- 50 mL sat. Aq. sodium thiosulfate (Na₂S₂O₃•5H₂O)

Surface roughness is the parameter of the smoothness of the surface it measure the peaks and valleys of the surfaces they are measured in grit which is number of scratches per inch smoother the surface is high the number Ra value it is the average value of the height of peaks and valleys lesser the value rougher is the surface. Coefficient of friction slightly depends on the roughness of the drum

2. Experimental Work and Discussions

The vehicle selected is Maruti 800 dx and has two different set of brakes Front are disc and rear are drum, drum brakes are selected as they are more important as in normal and emergency braking

Standard dimensions of new drum brake are Diameter of drum: 180 mm. The selected vehicle has run 62900 kilometers and the wear is checked in the drum brakes in rear wheels as well as dimensions of used brake drum as found As the brake drums are more costlier so they should be replaced very rarely so our focus is on brake drum rather than brake linings which are easier to replace



Figure 2.1: New Drum brake for Ra value



Figure 2.2: Used drum for microstructure and Ra value

Comparison of thickness of brake drum and lining of new and used brake to find the amount of wear

Table 1: thickness comparison

	Thickness	
	Drum	lining
new	3 mm	5 mm
used	2.96 mm	4 mm

Thickness of brake lining is reduced by 1mm and on brake drum is reduced by 0.4 mm Wear on brake linings is seen and decrease in thickness of brake lining is seen There is two body abrasive wear on lining is seen as the liner materials is removed or cutted by the brake drum and straight lining is seen on liner and material is removed from liner so it is expected that to replace the liner after every 5000 kms



Figure 2.3: etched sample of 1x1" sample of drum brake

This sample was used to perform the microstructure analysis and to find out Ra value of the Drum brake

2.1 Micro Structure analysis of drum brake : The drum under investigation was removed and new drum was replaced on its behalf . And sample of 1x1" in was submitted to the metallurgical lab for microstructure analysis and roughness analysis Also another sample pieces of old and new brakes were submitted for Ra (roughness) factor analysis. The above mention tests we carried out at ELCA LABS at thane The micro structure analysis was carried as per ASM H Book The longitudinal orientation with center location and 2% nital was used as etchant.

The microstructure analysis revealed that there was uniform distribution of Type A graphite Flakes in Pearlite matrix and the whole microstructure is grey cast iron The image below shows 200X magnified image of the drum brake

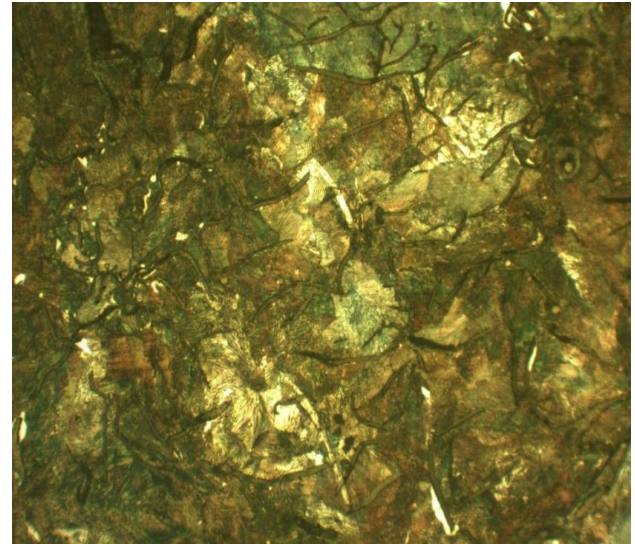


Figure 2.4: Microstructure of brake drum

The graphite flakes in the pearlite matrix lead to unmachinable surface due to presence of graphite the brake may break during machining the microstructure does not change

2.2 Surface roughness test of drum brake:

Surface roughness test was performed on the drum brake by using instrument handysurf E-35B and values of roughness are as below Ra(μm) is 1.9,2.0,5.4 The maximum and minimum values are from 1.2 to 3.5

Table 2.2: Table of new and old Ra value

Sr.	Ra value	Ra value of
1	1.2	1.9
2	3.5	2.0

So by comparing we can say that the Ra value of studied is near to lower limit but is not below lower limit of 1.3 the drum needs to be replaced when the value decreases below 1.2. The roughness of the drum has a slight effect on the coefficient of friction which for practical purposes may be neglected. The effect of the roughness of brake drums on the wear of linings is probably less in service than on the test machine

3. Conclusion

- As the vehicle is used as per prescribed and no excessive braking is occurred and no rough driving and intense application of brake is avoided and continuous and sudden application of brakes is also avoided as driving is smooth
- No Hot spots are seen on the drum brakes
- The microstructure analysis revealed that there was uniform distribution of Type A graphite Flakes in Pearlite matrix and the whole microstructure is grey cast iron
- values of roughness are Ra(μm) is 1.9,2.0,5.4

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