Advance Materials ManufacturingProcesses and Braking Assembly

Ya'qub Adamu

Department of Technical Education,College of Science and Technology
Hassan Usman Katsina Polytechnic, Katsina-Nigeria

Doi:10.5901/ajis.2014.v3n7p16

Abstract

*The brake assembly basically describes the in-plan vibration of a slider-mass which is driven around the surface of flexible disc, are investigated. The slider has the flexibility and damping in the circumferential (in-plane) and transverse directions. The numerous results show that initial braking pressure and the rotating speed of the drive point can drive the system into instability. While the rigidity and damping of the disc, and transverse stiffness and damping of the slider tend to suppress the vibrations. The motivation of this work is the understanding of the instability and in the physical systems such as car brake discs where there vibrations induced by non-smooth dry friction forces. The forming other components are: calipers and pads, all these makes the brake assembly. (Ashby, M F, Jones, D R H, 1996) The paper focuses on materials and the behaviors based on the following: *Operational requirement and service condition; *Design requirement; *How does this material affect current production method?; *Provide an alternative material to be used as the case may be; *Indicate a feasibility production route that could be considered for the alternative material proposed above*

1. Introduction

The brake assembly basically defines as device used in any machine to describe the following functions; to Slow, Stop and Rest (SSR). The brake assembly operates by means of: Air, fluid and cable. The focus of the paper is to address materials and analysis as it affects the operation of each brake components. Materials used generally described the bases of components formation; specifically materials determined the nature and the chemistry as it affect component forming. Ashby, Jones (1996) contributes that; "Materials today are fast evolving than any time in history. Industrial nations regards the development of new and improved materials as an underpinning technology one which stimulates innovation in all engineering branches making possible new designs for structures, appliances, engines, electrical and electronic devices, processing and energy conservation equipment and much more. Many nations have promoted their government-backed initiatives to promote the development and exploitation of new materials". This placed challenges for engineering to quickly work in time on new innovation, often takes the form of replacing a component made of one materials (a metal, say) with one made of another (a polymer, perhaps) and redesigning the product to exploit to the maximum, the potential offered by changes.

2. The operational requirement

The materials possess good resistance to distortion and cracking and are found in either alloyed form non alloyed variant are only employed where brake system required dictate that resistance to cracking and associated.

3. Operational requirement on brake discs

The brake discs are subjected to the highest stress from the contact pressure. Among the operational requirement, it must be pointed out that lining wear is proportional to the work done and therefore the natural rate of wear of the leader is about 3 times that of trailer. The braking requirement leads to the development of the first carbon composite brake discs, and this leads to rapid phase out of the cast iron as a disc material.

4. Operational requirement on brake caliper

The high temperature and pressures and the robbing speeds appear to beoccasionally helpful in keeping disc brake requirements, a basic measure is to suspend the brake in good condition. According to Onga, Reen, (2007) states that in

order to fulfill these requirements; a basic measure is to suspend the brake pad holders in such a way that they are only movable in a plane perpendicular to a centre-line of the caliper.

5. Operational requirement on brake pad

The pads are fitted into most floating calipers from the open, inner portion of the caliper. This has a propensity to withstand higher operating temperatures. The brake lining is riveted, boned or mould boned to the pad backing. In all cases the lining surface is flat and, except for swing-caliper designs the pad must withstand wear at all working condition. Giles (1969) opines that; pad and disc never approach the temperature and pressure for which they have really been designed. One of the desirable qualities in disc brake pad are that it should virtually incompressible (to save pedal travel), and be kind to the disc (to prevent scoring).

Design requirement for disc brake caliper and pad assembly: according to Ashby (2005) ;describes the following as the best choice of material based on design requirement.

- Bending stiffness, S^*, specified
- Dimension L and b specified
- Minimized mass of caliper
- Minimized heat transfer through caliper
- Thickness h of caliper wall
- Choice of material for the winding

6. The service condition of brake disc

The discs is checked regularly so that, the pad will be able to grip well if a brake is applied the stresses on the disc brake service condition further identify on the following conditions.

- Improper wheel tightening after tyre rotation
- Frequent brake inspection increases the spam of the brake disc.
- Excessive LRO causes brake pad to wear the rotors unevenly the pulsation be check for excessiveness.

7. The service condition of brake caliper

The brake caliper is the assembly which houses the brake pads and pistons. Overall brake squeal can be annoying to the vehicle passengers, passers-by, pedestrians etc especially as vehicle designs become quitter. Noise, vibration and harshness (NVH) are among the most important priorities for today's vehicle manufacturers of brake. Medium carbon high strength iron, High carbon.

Brake pads wear out over time requiring brake e service. The amount of time they last is based on factors such driving conditions and the way you apply your brakes. Periodic brake service is necessary to keep your car running safely especially with the high traffic condition.

8. Function of the brake disc

The brake disc is a device that slow or stop the rotation of the wheel, and usually this components is made from cast iron or ceramic composites, and connected to the vehicle wheel/axcle.

9. Justification of material used for brake component

To justify the materials for the component, the following justified the materials used; clearly states, Ashby (2005) that, the problem of the material should be specify, model and deging requirement these are factors that best describes material for components, the problem describe the thermal conductivity. The model is another aspect that best justified material for the component; the specifications for the brake disc caliper and pad assembly are in relation to the beam stiffness S is critical; if this is inadequate the disc brake caliper assembly will flex, impairing the brake efficiency and allowing vibration. The analysis of the force, beam and the heat flow will be showed in the schematic of disc brake caliper assembly. In the first two objects of the design requirement are minimizing mass and maximizing heat transfer. The mass of the caliper scales with that heat of one of the beams its mass perunit area is simply.

M_a =hpp(units: kg/m^2)where p is the density of the material q the heat transfer depend on thermal conductivity of the beam materials; the heat flux per unit area isq_a = (units: Watts/m^2) where T is the temperature difference between the surfaces. The quantities L, b, and T are specified. The only free variable is the thickness b. but there is constraint; the caliper must be stiff enough to ensure that it does not flex or vibrate excessively.

10. Review surface wear consideration

The surface considerations are applied to casting engineering, aesthetic and economic reasons. The surface industrial castings may be considered to provide improved surface related properties such as wear, fatigue and corrosion resistance. One the important objective of surface consideration is to improve surface appearance. The surface consideration permits a casting to meet mutually exclusive design objectives. The application of abrasion-resistance coating will enable a ductile iron casting to be both wear resistance, a surface property, and impact resistance. The main reason for using surface considered ductile iron casting is it offers the most cost effective means of meeting the objectives. Surface consideration applied to ductile iron casting include; thermal and mechanical hardening considerations. The action of fuse castings to reduce friction, improve wear and corrosion resistance; the electrode potential of metal casting to increase corrosion and wear resistance and improve appearance and application of diffusion casting to increase resistance to wear oxidation, and corrosion.

11. Surface geometrical stress concentrations

Basically stress concentration calculation analysis those components are smooth have a Reviewuniform section and no regularize. In practice virtually all engineering components in section or in shape. The theoretical or geometric stress concentration factor K_t or K_{ts} is used to relate actual maximum stress at the discontinuing to the nominal stress. K_t =Max direct/nominal shear stress.

Max stress = K_t X nominal stress. Most cast iron has very low q value. This is because their microstructures contain many notches, so additional machine once make little differences. A value of q = 0.2 will be on the safe side for all grades of cast iron.

12. Review surface corrosion issues

The surface corrosion issue can be reviewed through by reprositive approach design, the corrosion resistance rest on the outside alloy shell. Segues, Bella suggested (2001) the "(at the time durability projections take the conservative approach of ignoring the pressure of the inner stainless steel shell)". The surface corrosion issues can be reviewed through the followings:

Dulling or polished surface, etching by acid cleaners, or oxidation (discoloration) of steel are surface corrosion review issues. A surface corrosion can indicate a break down in the protective coating system; however it should be examined closely for more advanced attack if type of corrosion is allowed it can leads to more serious surface corrosion.

13. Indicate how corrosion issues can be addressed?

The corrosion issues can be addressed generally through practical controlled by catholic penetration; use on brake disc or simply by specifying a corrosion allowance in other cases uniform corrosion adds colors and appeal to surface corrosion.

14. Relate how the production routes impart micro structural changes to thematerial

Chapman mannion (1976) states that "the graphite type when evaluated according to ASTM 247, should alter with addition, the preferred graphite type A". The graphite size as carbon content increases so does the size of the graphic flakes, the corresponding decrease in tensile strength assuming of course that on alloy additions are made

15. Carbon Composites

David martin (1998) state that " there is no major brake performance advantage other than the weight saving, and the fact

that disc will operate at temperature approaching 1000 degree centigrade and inference from this is that higher brake loads cans be applied and the massive amount of heat generated can safely handled the use of such materials or production roads cars is most unlikely due to both the high cost factor and its poor low temperature performance.

16. Aluminum MMC Materials

The main challenges to the traditional cast iron disc will replace Aluminum MMC product. The properties of MMC materials have been widely examined and appear to offer several major advantages:

The thermal conductivity can be two or three times higher than cast iron:-

- An MMC disc disc could be 60% lighter than an equivalent cast iron component
- The thermal diffusivity which is the rate of heat dissipation compared to that of storage, is four times that of cast iron.

17. Indicate any feasible production route considered for alternative materialUsed in item 16.0 above

The alternative material being considered is nodular cast iron and its production route describes the process through which casting simply means shape achieved by allowing a liquid to solidly in mould . In casting many techniques are used to melt to produce shapes. Casting are often molted in a copula furnace, casting can be made in sand moulds metal, graphics mould and plaster mould by pouring lower pressured injection high pressure injection spinning, and so on. According to Kenneth Budinski (1999) opines that the casting can affect part design, the alloy the soundness and even the surface finish.

18. Conclusion

The study has made it very interesting with particular refreshment in the area of materials and its analysis, the utilization of this complex advanced materials analysis has made the study a competitive market research in automotive industries many aspect of materials research and development has make it possible to analyzed different components of automotive within the shortest possible time, material selection and CES as another vital area which uses research to identify various type of material with respect to mechanical and thermal properties.

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