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THE CALCULATED DEFORMED VOLUME OF THE BRAKE DRUM CASTING OF THE CAR

Abstract: The deformed volume of the aluminium casting of the car brake drum after crystallization in the metal mold is presented in the article. The results of the research are recommended for preliminary assessment of stress-strain state of the brake drum casting obtained by die casting.

Key words: the casting, die casting, deformation, crystallization, the volume.

Language: English

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Introduction

The brake drum is the main part of the brake system of the car. The brake drum is the case part, which is affected by the brake pads during braking. The brake drums are made of cast irons and silumins. These materials are frictional and have high strength.

Die casting is one of the methods obtaining the workpiece of the brake drum. This method allows to obtain higher density of the casting material in conditions of low castability of melt. The some researches of the processes of die casting of the metal workpieces are presented in the works [1-10]. So as the surfaces of the brake drum during operation in contact with the other surfaces of the parts then the material properties should be the same in the entire volume of the casting. The preliminary analysis of state of the brake drum material can be done when obtaining the solid model of the crystallized casting with casting defects.

Materials and methods

Casting of the brake drum of the car was carried out under pressure into the mold made of X37CrMoV5-1 steel (EN). Melt of ENAC-44200 silumin (EN) was poured into the pressing chamber of the injection molding machine at the initial temperature of 690 °C. Silumin melt has high CLF up and low CLF down and CLFpres. Injection of melt into the mold cavity was carried out through two gating channels with the diameters of 10 mm. The required volume of melt for casting of the brake drum was 1265992.52 mm³.

Results and discussion

The volume of deformed material of the brake drum casting after crystallization is presented in the Fig. 1. Compression and tensile of material are observed in 75% of the casting volume. Deformation of the casting material on periphery is more than in the centre (on the surfaces of the hole). The approximate ratio of maximum deformation of the casting material to minimum deformation is 2.3.

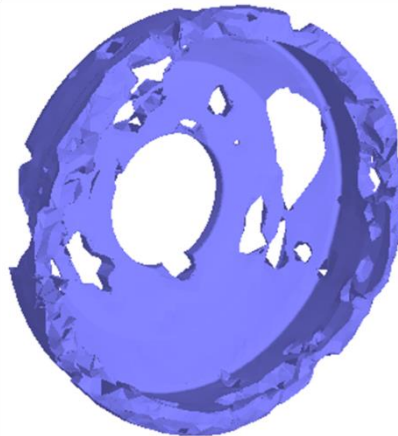


Figure 1 – The volume of deformed material of the brake drum casting after crystallization.

Rate of thermal deformation of material of the brake drum casting can be presented by the analytical formula (1):

$$v = \frac{VT_{cryst}}{4V_0t_{cryst}}, \quad (1)$$

where V is the deformed volume of the casting material after crystallization; T_{cryst} is the temperature range at which the casting crystallization occurs; V_0 is the initial volume of melt; t_{cryst} is the time range at which the casting crystallization occurs.

The crystallization temperature for the casting of the brake drum is 576.323 °C; the crystallization time is 14 s.

Conclusion

The volumes of the casting located near the injection channels of melt into the mold are subjected to less deformation after crystallization. The analytical formula presenting the dependence of rate of temperature deformation of the casting from the volume, the temperature and the crystallization time is obtained for casting of the aluminium brake drums of the car.

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