

Name : Mr.Somthai Seemasang

Thesis Title : The Study of the Effect of Heat
Conduction on Solidification of Cast
Iron Microstructure.

Major Field : Mechanical Engineering

Thesis Advisors : Dr.Tirachoon Muangnapoh,
Mr.Pairot Limphapayom

Academic year : 1994

Abstract

This research is to study the effect of heat conduction upon using steel mold towards the solidification of cast iron microstructure by considering of the workpiece hardness along the radial lines whereas the one dimensional heat transfer is assumed along this direction. Two types of cast iron steel mold are used, one is of plain carbon steel and the other is of tool steel, both having cylindrical shapes with the same height of about 140 mm, 25.2 mm in thickness, and having the same outside diameters of 128 mm. The size of the workpiece obtained is the typical roller size most used in the steel rolling mills.

We have found high heat conduction rate occurred during the beginning of the cast iron solidification in both types of steel molds, resulting in the formation of the cementite structure around the outer periphery of the workpiece. The depth of the cementite structure penetration measured inward along the radial direction is between 18.9 to 25.2 mm when using plain carbon steel mold, and

having wider range between 18.9 to 31.5 mm when using tool steel mold. The hardness measured on the outside workpiece surface is 40 Rockwell-C when using plain carbon steel mold, and of 42.2 Rockwell - C for tool steel mold. The formation of the carbon structure in the form of cementite structure is found not less than 1.2%. If more hardness on the surface is needed, higher heat conduction rate measured in the form of the temperature rate, measured on the workpiece surface must be higher than 2.6 degree cencius per second for the plain carbon steel mold, and be higher than 5.55 degree cencius per second for the tool steel mold. These can be achieved by considered using higher mold thickness or using higher thermal conductivity materials. From the experiment, it is observed that there have much lower heat conduction rate in the middle region of the workpiece, and the structure of gray cast iron is formed having matrix structure of ferrite pearlite containing graphite flakes.

In addition, the solidification rate as measured by the thickness growth varies with the square root of the cooling time.