

STUDY ON VORTEX FORMATION IN THE POURING BASIN BY DIRECT OBSERVATION

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ABSTRACT

Although the formation of vortex on the free surface of liquid draining from a container is often observed, relatively little is known about the phenomenon. When a liquid is drained from a container such as a bathtub through a bottom orifice, a dip on the surface known as vortex is formed. The vortex first appears as a small dimple in the free surface, which suddenly forms a cone-shaped hole. The vortex causes turbulences, which draws in air down into the orifice (drain).

Generally, the issue of vortex formation is so common in our lives that possibly its occurrence seems to be taken for granted and this is, perhaps why the subject has received relatively little scientific attention. Mathematically a derivation is known but it does not take into consideration variables such as shape and size of the container or the draining orifice. Experiments were carried out using containers of different shapes and sizes, orifices of different shapes and sizes placed at different points in the container. The minimum head in the container that prevents the formation of vortex has been determined and is the function of container and orifice geometry.

Keywords

Free vortex, pouring basin, orifices, film forming alloys, critical height, free surface

INTRODUCTION

Scientific principles are increasingly being applied to gating system, more attention being rendered to the sprue, runner and ingate components. Investigations on these elements have been carried out and detailed reviews of their designs and their effects on the quality of castings highlighted. However, pouring basin where the pouring and consequent filling of the casting commences, has received less consideration. It is important to note that the relative position of the pouring basin within the gating system renders it a big role to play in achieving the casting's quality.

Vortex formation on the surface of liquid during pouring process is a common phenomenon although little is known about it. In foundry practice it may lead to contamination of the molten metal by air/gases, slag and dross. A good knowledge of the behavior of the flow of liquids is necessary in order to be able to study vortex formation in a pouring basin.

A pouring basin, which can be described as the enlarged offset portion of the mouth of the gating system into which the molten metal is

poured to flow, reach and fill the mold cavity acts as a reservoir for the molten metal during pouring process. When molten metal is poured in the pouring basin, atoms in liquid metal at the surface are attracted by the interior atoms and experience no balancing attraction from above the surface. This effect of atom cohesion causes the liquid metal surface to behave as though it were covered with an elastic membrane.

However, molten metal draining through the sprue entrance hole from a pouring basin, tends to form a whirlpool action in the spiral motion known as vortex, which occurs as the fluid level in the pouring basin decreases. This implies that the selection of the pouring basin should not only be governed by the requirement to rapidly and progressively introduce the metal to the sprue cavity but should also be dependent on among the other economic and practical considerations, the elimination of vortex formation in the metal. The optimum-pouring basin is one, which will eliminate vortex formation, deliver the metal to the sprue cavity within the shortest possible time and with least amount of metal poured in it.

