Vacuum Suction Core - making Process

A C Reddy, Non-member

This paper deals with design and development of a new vacuum suction core-making process. The tensile properties of shell cores and surface roughness of Al-12%Si castings made by gravity and vacuum fillings have been studied.

***Keywords**: Vacuum suction, Gravity filling, Shell core.*

INTRODUCTION

Cores are sand shapes which produce hollow castings. The cores should be well packed, free from discontinuities and porosities and characterized by good permeability and shake out properties. The cores also should have stability of dimensions and shapes during handling, mould preparation and casting and should ensure high surface finish of castings. Constant research work in the field of core-making processes has been undergoing for process development to respond the need of the present-day quality consciousness. As a result a large number of new processes[1-5] have been developed. These processes in one way or the other have eliminated certain shortcomings to the conventional process.

In the present work, an attempt was made to develop a new vacuum suction core-making process and to study the effect of process variables on the performance of cores.

EXPERIMENTAL DETAILS

Materials

Silica sand of grain fineness 40, 60 and 90 and phenol formaldehyde resin were employed to make shell cores. Cover all-11 (a Foseco product) was used over molten Al-12% Si alloy to minimize the oxidation of molten metal during melting.

Equipment

A schematic representation of the vacuum suction core-making machine is shown in Fig. 1. The hopper stores the resin-coated sand. A regulator is fitted to the bottom of main chamber which has a funnel-like structure. The regulator is fitted with a regulating rod which controls the flow of sand from the main chamber to core box through an upper grip plate. The regulating rod can be rotated inside the regulator round 360^o. The rod is rotated by 90^o to align its orifice with the holes f main chamber, regulator and upper grip plate which allow the sand into the core box. When the rod is further turned 90o, the hole of the regulator is closed and thus it arrests the flow of sand into the core box. A lower grip plate is attached with a nozzle which is connected to a vacuum pump. The lower grip plate is placed on a table which is raised or lowered by a turn rod. When the core box is placed in between lower and upper grip plates, the table is raised till air leak-proof is attained.

Procedure

The nozzle of the vacuum suction core-making machine was connected to the vacuum pump by a hose pipe. The core box

A C Reddy is with the Department of Mechanical Engineering, M J College of Engineering and Technology, Hyderabad 500 034

This paper was received on December 13, 1996. Written discussion on this paper will be entertained till July 31, 1998.

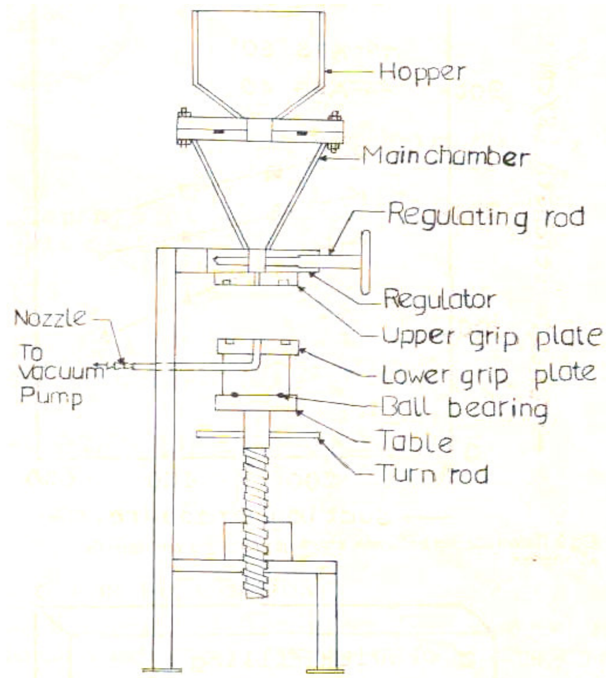

Fig 1 Schematic representation of vacuum suction core making machine

was heated to a baking temperature of 180^{o}C in an oven. The two halves of core box were sprayed with silicon emulsion for easier removal of cores. The two halves of core box were clamped by using C-clamp. The core box then placed in between lower and upper grip plates. The table was raised till there was no air leak into the core box. The regulating rod was rotated to allow the sand into the core box. The vacuum pump was started to suck and compact shell core sand. The sand was allowed for curing. The core box was opened and the core was ejected out. The cores were also made under gravity filling (*ie* without applying vacuum pressure).

In the preparation of the cores, sand grain fineness and vacuum pressure were used as control factors. Tensile strength of the cores and surface roughness of Al-12% Si castings were taken as the variables to study the performance of vacuum suction core-making process. The cores were tested for tensile properties on a universal sand strength testing machine and surface roughness of castings was tested suing Stylus-linear variable differential transformer method[6].

RESULTS AND DISCUSSION

The percentage of phenol formaldehyde resin and baking temperature which is maintained constant for core-making are 4 and 180°C, respectively. The influence of suction pressure on the tensile strength of cores is shown in Fig.2. It can be noticed that for any given sand, as the absolute suction pressure is decreased, the tensile strength of cores increases. It also appears that the 90AFS sand has higher strength when compared to 40AFS and 60AFS sand. The lower the suction pressure the better will be the compactness of sand inside the

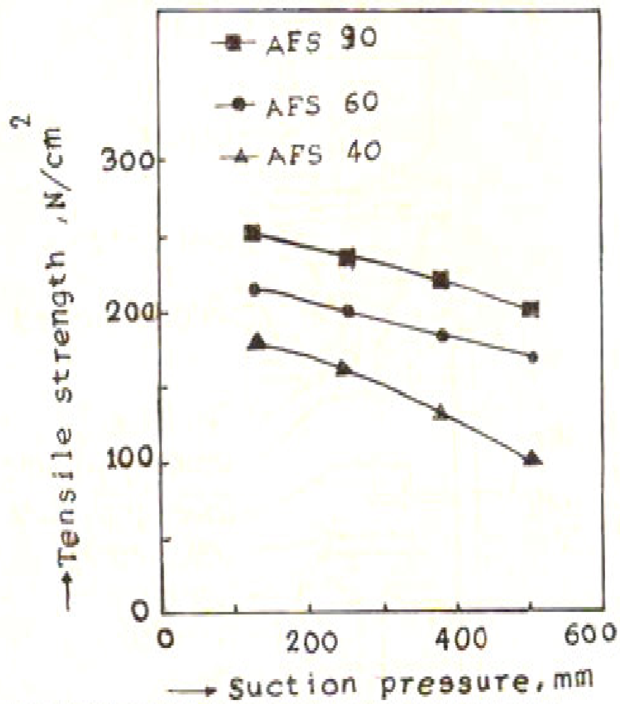

Fig 2 Relationship between suction pressure and tensile strength

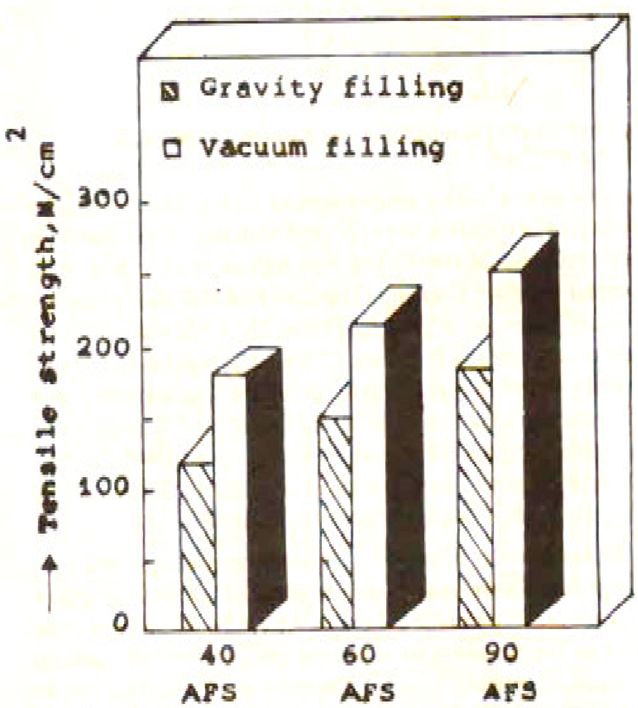

Fig 3 Relationship between grain fineness and tensile strengtn

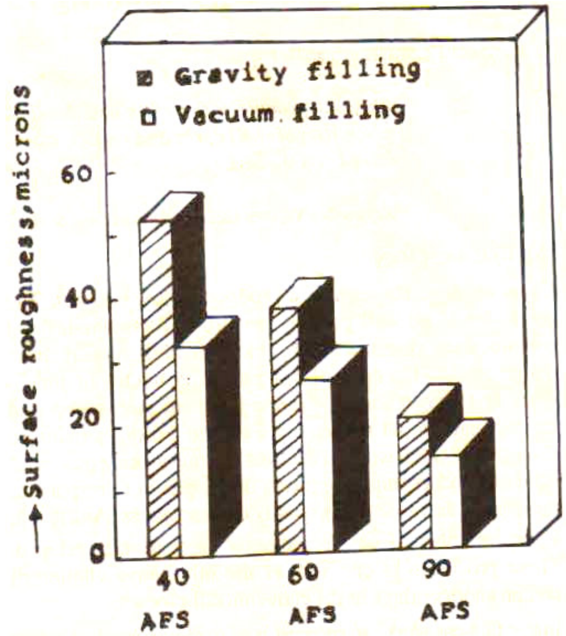

Fig 4 Relationship between grain fineness and surface roughness

core box. A good compacted sand would result in higher tensile strength of cores. It is also observed from Fig. 3 that the tensile strength of cores made in vacuum suction process is higher than that of cores produced by gravity-filling method. Fig 4 shows the surface finish of Al-12% Si castings. The higher surface finish of castings with cores made by vacuum suction process may be due to low metal penetration into the cores. It is obvious that the fine sand would give smoother surface.

CONCLUSION

The tensile strength fo cores produced in the vacuum suction process was higher than that of those by gravity-filling method the surface finish of castings suing cores made by vacuum suction process was superior.

REFERENCES

1. K. Briggs. 'Development of Warm Box Process,' *Journal of British Foundrymen*, vol 79, July 1986, p251.
2. M C Killip and J William. 'Warm Box Process: An Alternative Core Production Process for Casting,' *Journal of British Foundrymen*. vol 80, November 1987, p 416.
3. S M Pelczarsi, 'Phenomena Occurring during the filling of the cores Box on Core Blower and Shooter,' *Journal of British Foundrymen*, vol 64, January 1971, p 2.
4. O Kroemker. 'Modern Core-kaking Technique and Development of Core Production Centres,' Giessere I praxis (translated from German), April 1985, p124.
5. A G Fennel. 'Modern Core-maing Process used to Advantage,' *Journal of British Foundrymen*, vol 67, May 1974, p 119.
6. 6. A C Reddy. 'Measuring Surface Roughness: A Simple Method,' Engineering Advances, vol .8, October 1996, p74.